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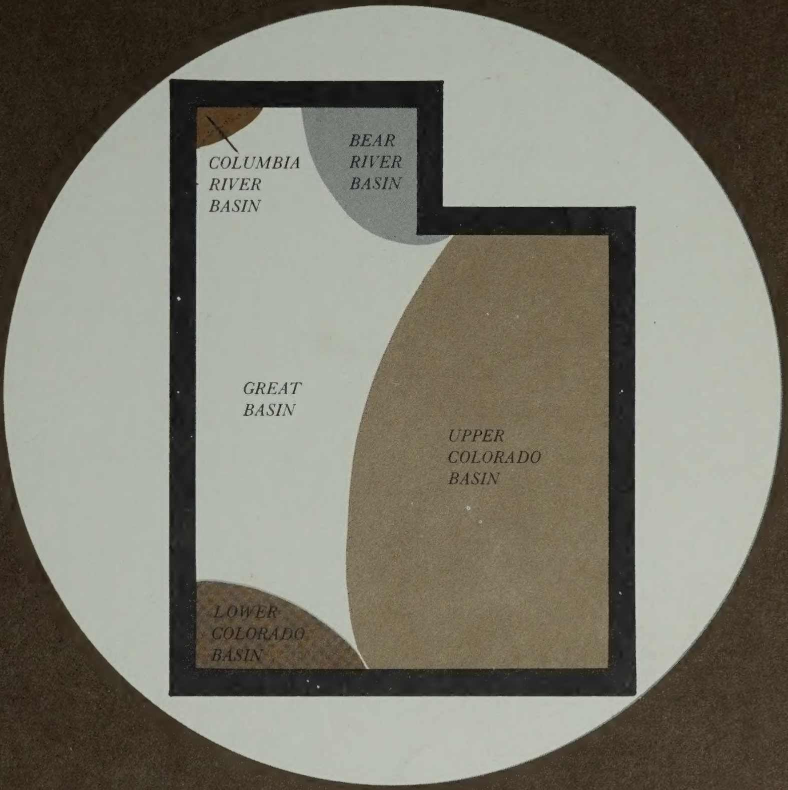

DEVELOPING A STATE WATER PLAN

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1968

COOPERATIVE INVESTIGATIONS REPORT NO. 6

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DEVELOPING A STATE WATER PLAN

Ground-Water Conditions in Utah, Spring of 1968

by

R. M. Cordova and others

United States Geological Survey

Prepared by the United States Geological Survey
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INTRODUCTION

This report is the fifth in a series of annual reports that describe ground-water conditions in Utah. Reports in the series are prepared cooperatively by the U.S. Geological Survey and the Utah Division of Water Resources and are designed to provide data for interested parties, such as legislators, administrators, and planners, to keep abreast of changing ground-water conditions.

This report, like the others (see references, p. 105), contains information on well construction, ground-water withdrawals, water-level changes, and related changes in precipitation and streamflow. It also contains supplementary data that are related to ground-water use in some areas. In reports of this series, the inclusion of such supplementary data as graphs showing chemical quality of water and maps showing water-table configuration is intended only for those years or areas where applicable data are available and are important to a discussion of changing ground-water conditions.

The report includes individual discussions of the most important areas of ground-water withdrawal in the State for the calendar year 1967. Water-level fluctuations, however, are described for the period spring 1967 to spring 1968. Included for the first time in this series of annual reports is a (1) summation of the withdrawal of water from wells in the 5 years 1963-67 (table 3), and (2) maps and discussions of water-level changes for the 5-year period, 1963-68. Many of the data used in this report were collected by the Geological Survey in cooperation with the Division of Water Rights, Utah Department of Natural Resources.

The following reports dealing with ground water in the State were released by the Geological Survey during 1967:

Ground-water conditions in Utah, spring of 1967, by C. H. Baker Jr., Don Price, and others: Utah Division of Water Resources Coop. Inv. Rept. 5.

Ground-water conditions in Cedar Valley, Utah County, Utah, by R. D. Feltis: Utah State Engineer Tech. Pub. 16.

Ground-water resources of northern Juab Valley, Utah by L. J. Bjorklund: Utah State Engineer Tech. Pub. 17.

Hydrologic reconnaissance of Skull Valley, Tooele County, Utah, by J. W. Hood and K. M. Waddell: Utah Department of Natural Resources Tech. Pub. 18.

The effect of pumping large-discharge wells on the ground-water reservoir in southern Utah Valley, Utah County, Utah, by R. M. Cordova and R. W. Mower: Utah State Engineer Inf. Bull. 18.

Hydrologic and climatologic data, 1966, Salt Lake County, Utah, by A. G. Hely, R. W. Mower, and C. A. Horr: U.S. Geol. Survey open-file report (duplicated as Utah Basic-Data Release 13).

Reconnaissance of the chemical quality of water in western Utah, Part I, Sink Valley area, drainage basin of Skull, Rush, and Government Creek Valleys and the Dugway Valley-Old River Bed area, by K. M. Waddell: Utah Geol. and Mineralog. Survey Water-Resources Bull. 9.

UTAH'S GROUND-WATER RESERVOIRS

Small quantities of ground water can be obtained from wells throughout much of Utah, but large supplies that are of suitable chemical quality for irrigation, public supply, or industrial use, generally can be obtained only in specific areas. These areas of known or potential ground-water development are shown in figure 1 and named in table 1. Only a few wells outside of these areas yield large supplies of water of good chemical quality.

Less than 2 percent of the wells in Utah obtain water from consolidated rocks. The consolidated rocks that yield the most water are lava flows such as basalt, which contains interconnected vesicular openings or fractures; limestone, which contains openings enlarged by solution; and sandstone, which contains interconnected openings between the grains that form the rock. Most of the wells that tap consolidated rocks are in the eastern and southern parts of the State, in areas where water supplies cannot be readily obtained from unconsolidated rocks.

More than 98 percent of the wells in Utah draw water from unconsolidated rocks. These rocks may consist of boulders, gravel, sand, silt, or clay, or a mixture of some or all of these sizes. Wells obtain the largest yields from the coarser materials that are sorted into deposits of equal grain size. Most wells that tap unconsolidated rocks are in large intermountain basins, which have been partly filled with debris from the adjacent mountains.

TABLE 1.

Areas of known or potential ground-water development in Utah

(locations are shown in fig. 1.)

	Area	*Type of water-bearing rocks*
1.	Curlew Valley	Unconsolidated
2.	Park Valley	Do.
3.	Grouse Creek valley	Do.
4.	Hansel Valley	Do.
5.	Blue Creek valley	Do.
6.	Sink Valley	Do.
7.	Malad-Lower Bear River valley	Unconsolidated
8.	Valley east of the Pilot Range	Do.
9a.	East Shore area, Weber Delta and Bountiful districts	Do.
9b.	East Shore area, Brigham district	Do.
10.	Jordan Valley	Do.
11.	Cache Valley	Do.
12.	Bear Lake valley	Do.
13.	Upper Bear River valley	Do.
14.	Ogden Valley	Do.
15.	Morgan Valley	Do.
16.	Park City area	Do.
17.	Kamas Valley	Do.
18.	Heber Valley	Do.
19.	North flank Uinta Mountains	Do.
20.	South flank Uinta Mountains	Do.
21.	Uinta Basin	Do.
22.	Tooele Valley	Do.
23.	Skull Valley	Do.
24.	Dugway area	Do.
25.	Fish Springs Flat	Do.
26.	Sevier Desert	Do.
27.	Rush Valley	Do.
28.	Cedar Valley	Do.
29.	Utah and Goshen Valleys	Do.
30.	Juab Valley	Do.
31.	Sanpete Valley	Do.
32.	Central Sevier Valley	Do.
33.	Upper Sevier Valleys	Do.
34.	Deep Creek valley	Do.
35.	White Valley	Do.
36.	Snake Valley	Do.
37.	Pine Valley	Do.
38.	Wah Wah Valley	Do.
39.	Escalante Valley, Beryl-Enterprise district	Do.
40.	Escalante Valley, Milford district	Do.
41.	Beaver Valley	Do.
42.	Cedar City Valley	Do.
43.	Parowan Valley	Do.
44.	Upper Fremont Valley	Do.
45.	Lower Fremont Valley	Consolidated
46.	Spanish Valley	Unconsolidated
47.	Castle Valley (Grand County)	Do.
48.	Montezuma Creek area	Consolidated
49.	Kanab area	Unconsolidated
50.	St. George area	Do.
51.	Pavant Valley	Do.
52.	Colton area	Consolidated
53.	Scipio area	Do.
54.	Lisbon Valley	Do.
55.	Monticello area	Do.
56.	Blanding area	Do.
57.	Bluff area	Do.

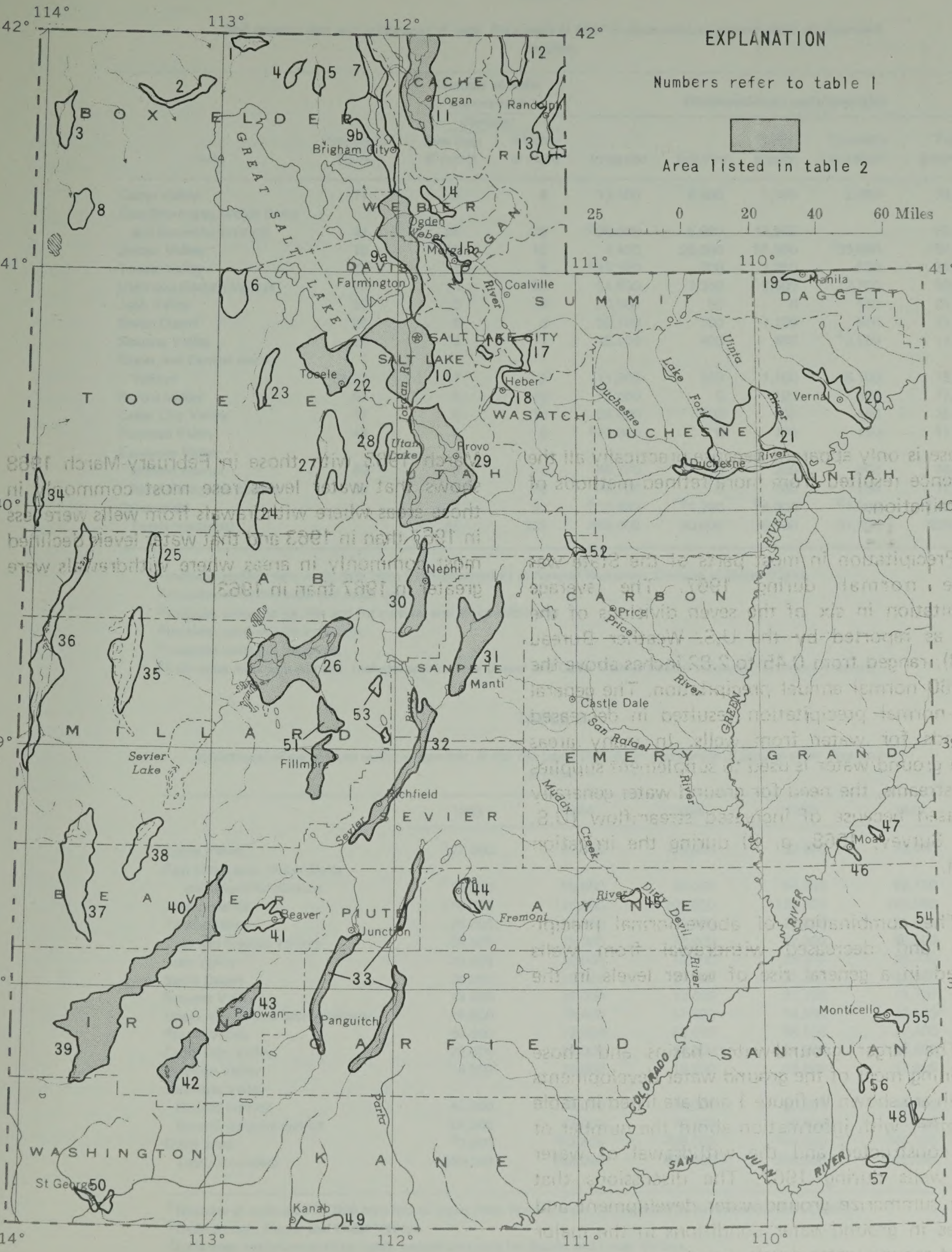

Figure 1.—Map of Utah showing areas of known or potential ground-water development.

TABLE 2.

Well construction and withdrawal of water from wells in 1967 in major areas of ground-water development in Utah.

Area	Number in figure 1	Number of wells completed [1]		Withdrawal from wells (acre-feet)				
		Diameter						
		Less than 6 inches	6 inches or more	Irrigation	Industry	Public supply	Domestic and stock	Total (rounded)
Cache Valley	11	9	8	13,400	6,800	1,350	2,050	23,600
East Shore area, Weber Delta and Bountiful districts	9a	24	16	[2]29,500	5,000	18,200	--	52,700
Jordan Valley	10	13	16	4,400	28,800	35,900	[3]33,800	102,900
Tooele Valley	22	1	5	[2]19,350	700	1,250	100	21,400
Utah and Goshen Valleys	29	10	24	51,600	7,300	8,900	12,700	80,500
Juab Valley	30	0	0	20,500	50	0	150	20,700
Sevier Desert	26	9	3	30,100	100	1,100	600	31,900
Sanpete Valley	31	9	1	10,400	400	400	[4]3,500	14,700
Upper and Central Sevier Valleys	32,33	17	8	11,300	100	1,100	6,100	18,600
Pavant Valley	51	0	12	77,000	0	100	300	77,400
Cedar City Valley	42	0	13	24,800	100	800	150	25,800
Parowan Valley	43	0	6	[5]17,300	0	100	150	17,600
Escalante Valley								
Milford district	40	0	4	45,700	100	200	600	46,600
Beryl-Enterprise district	39	0	16	70,700	0	100	600	71,400
Other areas		7	91	[6]31,900	[6]1,200	[6]6,600	[6]1,000	[6]40,700
Totals (rounded)		99	223	458,000	50,600	76,100	61,800	650,000

[1] Includes replacement wells; data from Utah Department of Natural Resources, Division of Water Rights.

[2] Includes some domestic and stock uses.

[3] Includes some use for fish and fur culture, and air conditioning.

[4] Includes some use for irrigation.

[5] Includes some use for stock.

[6] Estimated minimum amount. Includes amounts for Beaver and Cedar Valleys treated separately in previous reports.

TABLE 3.

Withdrawal of water from wells, in acre-feet, in the five years 1963-67 in major areas of ground-water development in Utah

	1963	1964	1965	1966	1967
Cache Valley	[1]27,000	29,000	28,000	32,900	23,600
East Shore area, Weber Delta and Bountiful districts	36,000	55,000	59,000	54,600	52,700
Jordan Valley	110,000	110,000	102,300	126,300	102,900
Tooele Valley	25,000	21,000	20,000	24,800	21,400
Utah and Goshen Valleys	86,000	75,000	73,000	97,800	80,500
Juab Valley	20,800	19,000	18,000	25,400	20,700
Sevier Desert	26,000	30,000	27,000	31,300	31,900
Sanpete Valley	13,000	16,000	12,000	21,100	14,700
Upper and Central Sevier Valleys	19,600	18,400	17,600	19,500	18,600
Pavant Valley	80,000	72,000	68,800	88,500	77,400
Cedar City Valley	22,000	22,000	16,000	24,800	25,800
Parowan Valley	14,000	16,000	15,000	19,600	17,600
Escalante Valley					
Milford district	43,000	45,000	44,000	50,200	46,600
Beryl-Enterprise district	64,000	72,000	70,000	78,900	71,400
Other areas	[2]7,600	[3]42,800	[3]38,200	[3]44,600	[3]40,700
Totals (rounded)	590,000	640,000	610,000	740,000	650,000

[1] Includes an estimated 21,000 acre-feet of water from flowing wells not reported by Arnow and others (1964).

[2] Includes only Beaver and Cedar Valleys.

[3] Estimated minimum amount; totals include amounts for Beaver and Cedar Valleys.

MAJOR AREAS OF GROUND-WATER DEVELOPMENT

CACHE VALLEY

by L. J. Bjorklund

Cache Valley is about 60 miles long, from north to south, and averages about 10 miles in width. About 60 percent of the valley is in Cache County, Utah, and about 40 percent is in Franklin and Bannock Counties, Idaho. Ground water occurs under both water-table and artesian conditions in the unconsolidated material underlying most of the valley. The most productive aquifers consist of gravel and sand which underlie the eastern part of the valley south of Richmond, Utah, and the western part of the valley north of Weston, Idaho. About 2,000 wells, most of which flow, are finished in these aquifers.

A water-level contour map of Cache Valley is shown in figure 2. The map shows the general configuration of the water table and piezometric surfaces in the ground-water reservoir of the valley fill. The map is based on water-level measurements made during March 1968 and land-surface altitudes estimated from topographic maps of the area. Ground water generally moves in the same direction as streamflow from the margins of the valley to points of discharge mainly in the lower areas of the valley. Recharge to the ground-water reservoir occurs mostly along the margins of the valley.

A total of 18 new wells were constructed in Cache Valley during 1967, and 17 of these were in Utah. Of the wells drilled in Utah, 9 were less than 6 inches in diameter and 8 were 6 inches or more in diameter. In Utah, 3 wells were drilled for irrigation, 13 for domestic and stock purposes, and 1 for public supply. The well drilled in Idaho replaced a 12-inch well used for irrigation.

The discharge from pumped and flowing wells in Cache Valley during 1967 was about 23,600 acre-feet of water in Utah and 5,000 acre-feet in Idaho, broken down as follows:

	Pumped	Flowing	Total
Utah			
Irrigation	3,400	10,000	13,400
Industry	400	6,400	6,800
Public supply	1,000	350	1,350
Domestic and stock	50	2,000	2,050
Subtotal (rounded)	4,800	18,800	23,600
Idaho			
Irrigation	3,300	1,200	4,500
Industry	350	0	350
Domestic and stock	100	50	150
Subtotal (rounded)	3,800	1,200	5,000
Total (rounded)	8,600	20,000	28,600

The total discharge from wells in Cache Valley, Utah, during 1967 was 9,300 acre-feet less than that estimated for 1966 (Baker, Price, and others, 1967, p. 17). The difference is mainly due to refinement of the method of estimating discharge from flowing wells, and is partly due to less discharge for irrigation because in 1967 larger quantities of surface water were available for irrigation.

Water levels rose in most of Cache Valley from March 1967 to March 1968 (fig. 3). The general rise was due to significant recharge from the melting of heavy snow cover on unfrozen ground in the valley during the latter part of the winter and to less discharge from wells during the irrigation season.

Water levels rose from March 1963 to March 1968 in most of Cache Valley in Utah[1] (fig. 4). This rise is in response to above-normal precipitation during 4 of the 5 years of the period 1963-67.

The long-term relation between fluctuations of water levels and precipitation is shown in figure 5 by the hydrograph of the water level in well (A-12-1)29cab-1 and the graph showing cumulative departure from normal annual precipitation at Logan Utah State University. The rise in water level from March 1967 to March 1968 resulted from above-normal precipitation and decreased pumping for irrigation in 1967.

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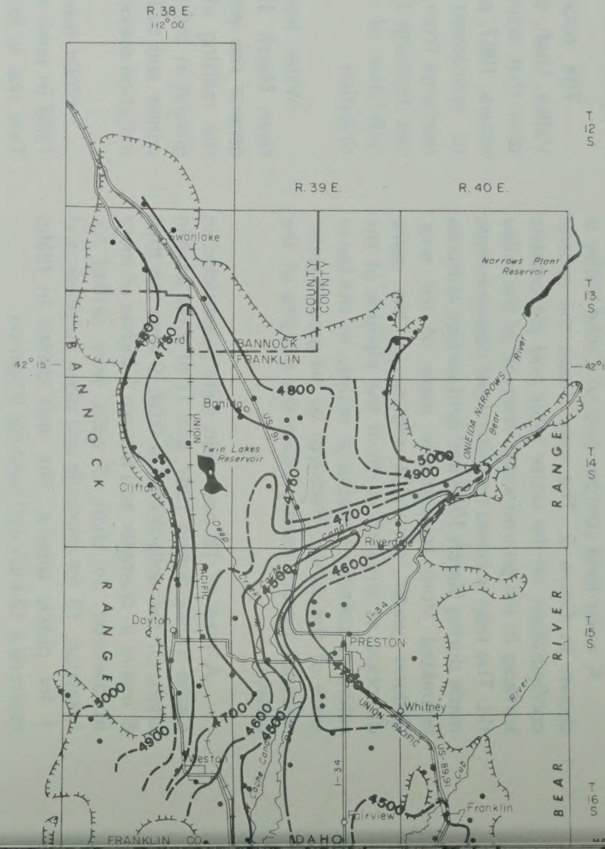
[1] Data for March 1963 were not available for Idaho.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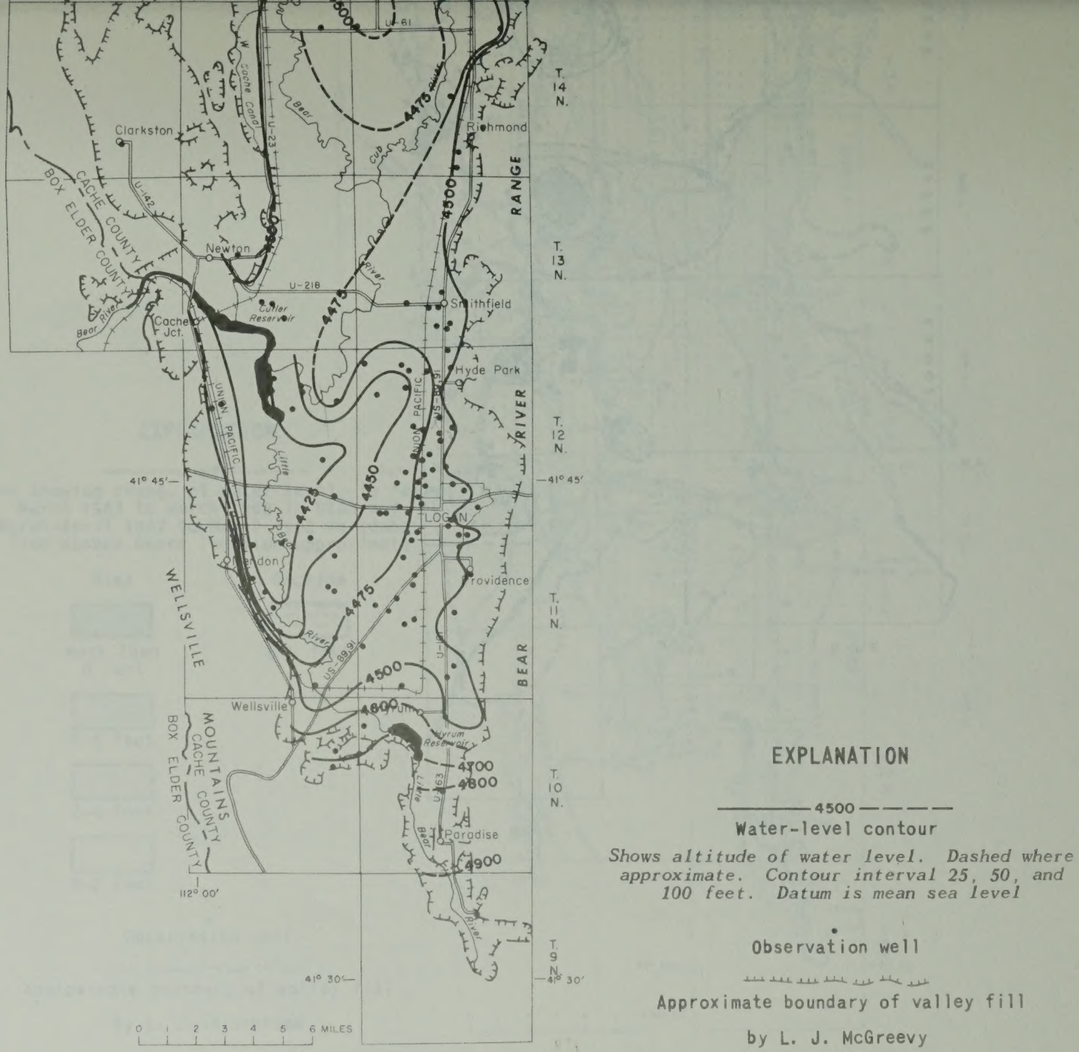


EXPLANATION

——— 4500 — — —
Water-level contour

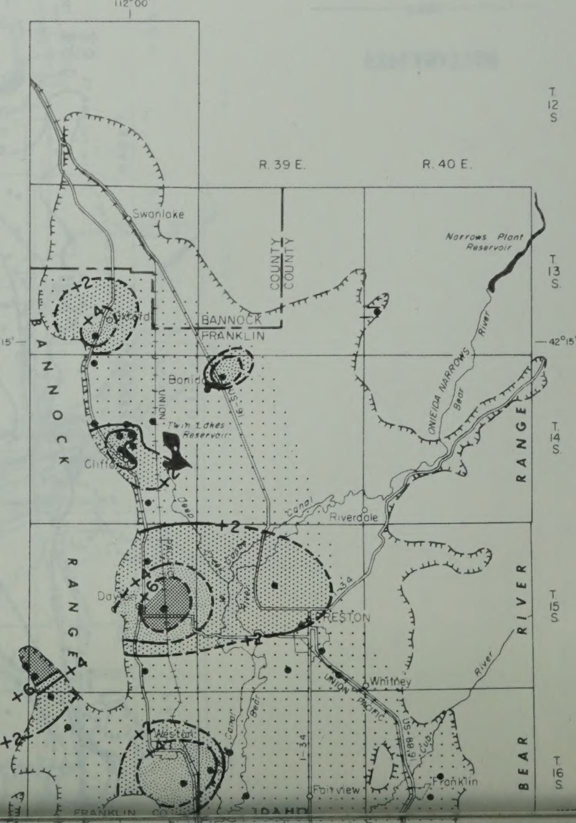
Shows altitude of water level. Dashed where approximate. Contour interval 25, 50, and 100 feet. Datum is mean sea level

•
Observation well

Approximate boundary of valley fill

by L. J. McGreevy

Figure 2.—Map of Cache Valley, Utah and Idaho, showing water-level contours, March 1968.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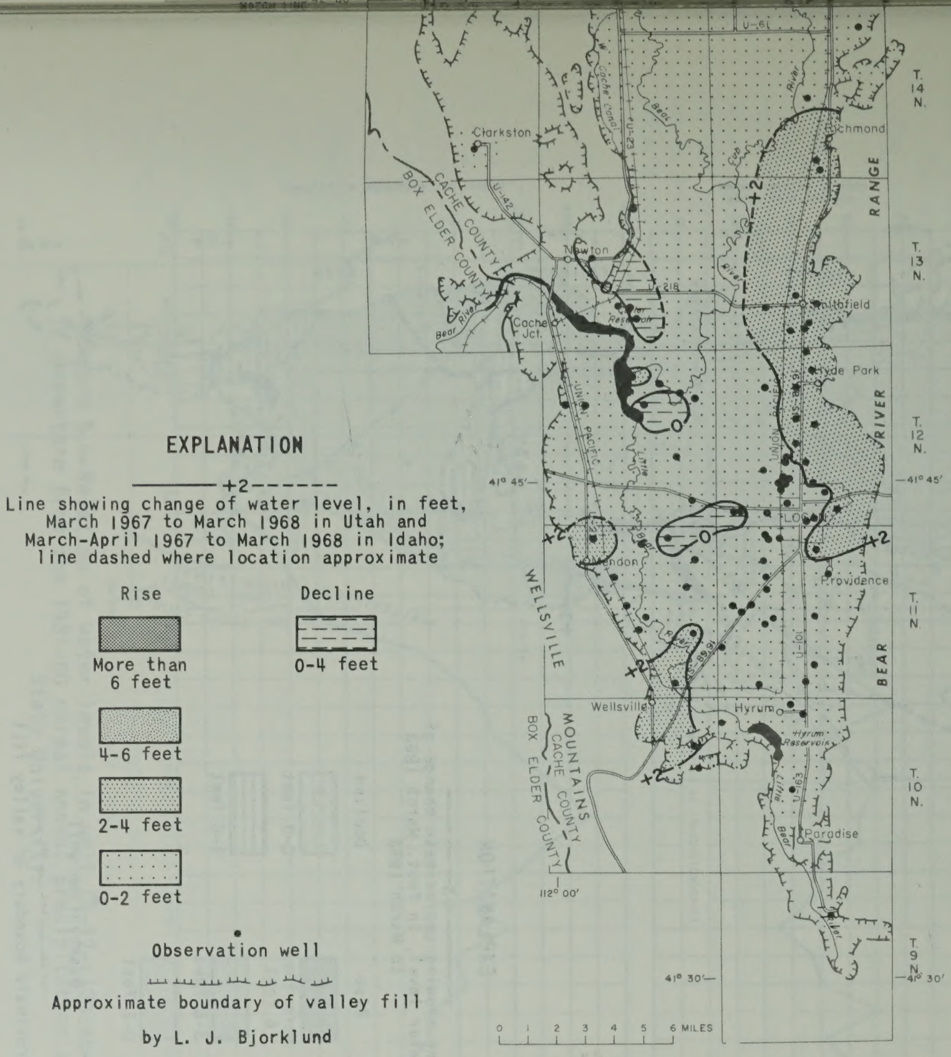


Figure 3.—Map of Cache Valley showing change of water levels from March 1967 to March 1968 in Utah and from March-April 1967 to March 1968 in Idaho.

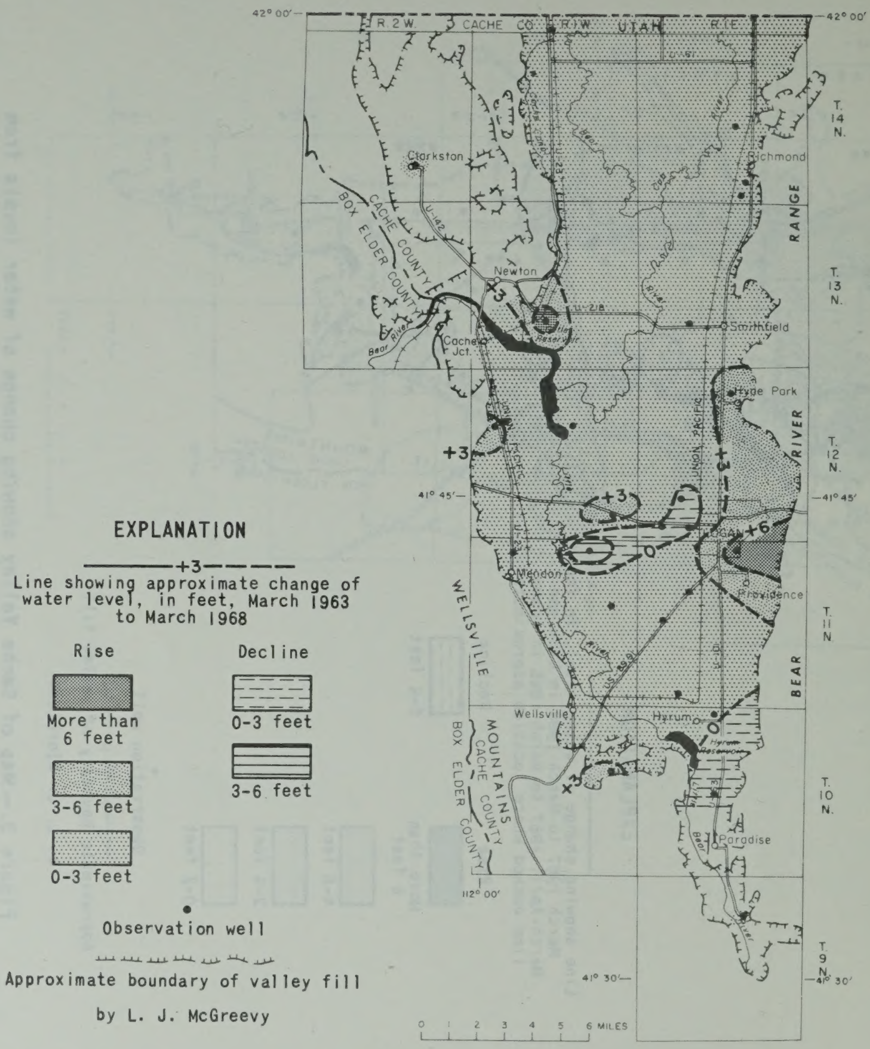


Figure 4.—Map of Cache Valley in Utah showing change of water levels from March 1963 to March 1968.

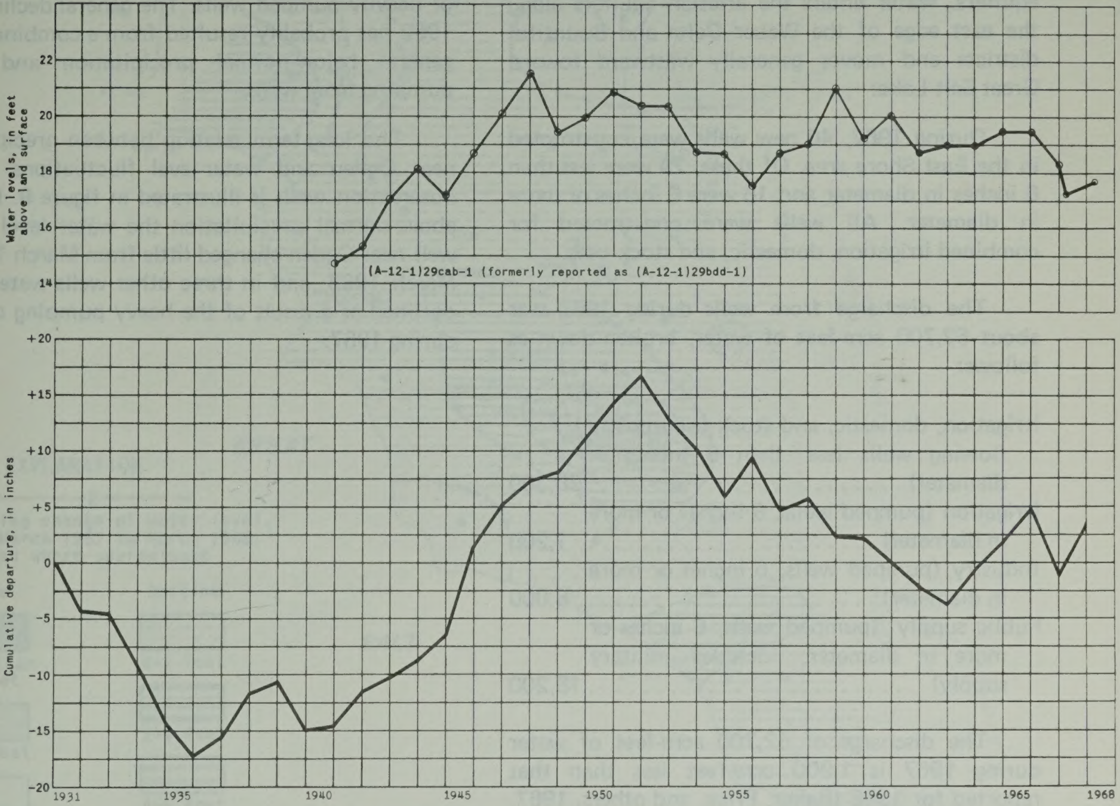


Figure 5.—Relation of water levels in well (A-12-1)29cab-1 to cumulative departure from the 1931-60 normal annual precipitation at Logan Utah State University.

EAST SHORE AREA, WEBER DELTA AND BOUNTIFUL DISTRICTS

by R. G. Butler

The East Shore area is in north-central Utah between the Wasatch Range and Great Salt Lake. Ground water occurs in unconsolidated deposits under both water-table and artesian conditions, but most of the water is obtained from the artesian aquifers. Water enters the artesian aquifers along the east edge of the Weber Delta and Bountiful districts and moves generally westward toward Great Salt Lake.

During 1967, 40 new wells were constructed in the East Shore area. Of these, 24 were less than 6 inches in diameter and 16 were 6 inches or more in diameter. All wells were constructed for combined irrigation, domestic, and stock uses.

The discharge from wells during 1967 was about 52,700 acre-feet of water, broken down as follows:

Irrigation, domestic, and stock use (mostly flowing wells less than 6 inches in diameter)	28,300
Irrigation (pumped wells, 6 inches or more in diameter)	1,200
Industry (pumped wells, 6 inches or more in diameter)	5,000
Public supply (pumped wells, 6 inches or more in diameter; includes military supply)	18,200

The discharge of 52,700 acre-feet of water during 1967 is 1,900 acre-feet less than that reported for 1966 (Baker, Price, and others, 1967, p. 20); the decrease is due chiefly to a decrease in the amount of water discharged from flowing wells. The total discharge from public-supply and industrial wells was 800 acre-feet more than the amount reported for 1966.

Water levels declined in most parts of the East Shore area from March 1967 to March 1968 (fig. 6). The greatest declines were southeast of Clearfield as the result of heavy pumping of wells. Rises outside the main areas of influence of the pumped wells resulted from above-normal precipitation in 1967.

Water levels declined in most parts of the East Shore area from March 1953 to March 1968 (see fig. 7) and from March 1963 to March 1968 (see fig. 8). The area of greatest decline is southwest of Hill Air Force Base where there is a concentration of heavily pumped wells. The general decline since 1952 has probably resulted from a combination of general below-normal precipitation and heavy pumping from wells.

The long-term relation between precipitation near Ogden and water-level fluctuations in five observation wells is illustrated in figure 9. Despite above-normal precipitation the water level in the well near Ogden changed little from March 1967 to March 1968, and in three other wells water levels declined as a result of the heavy pumping of wells during 1967.

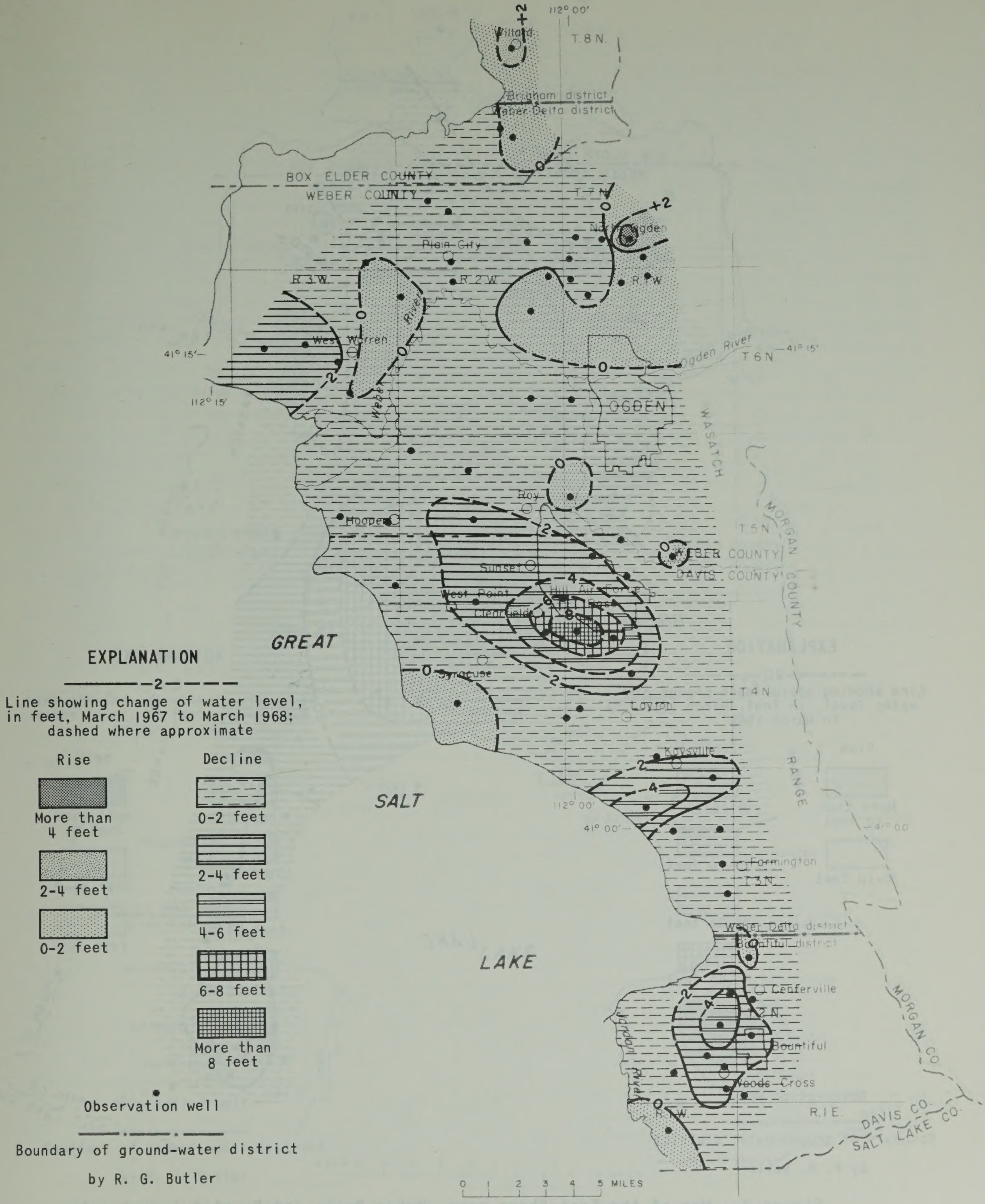
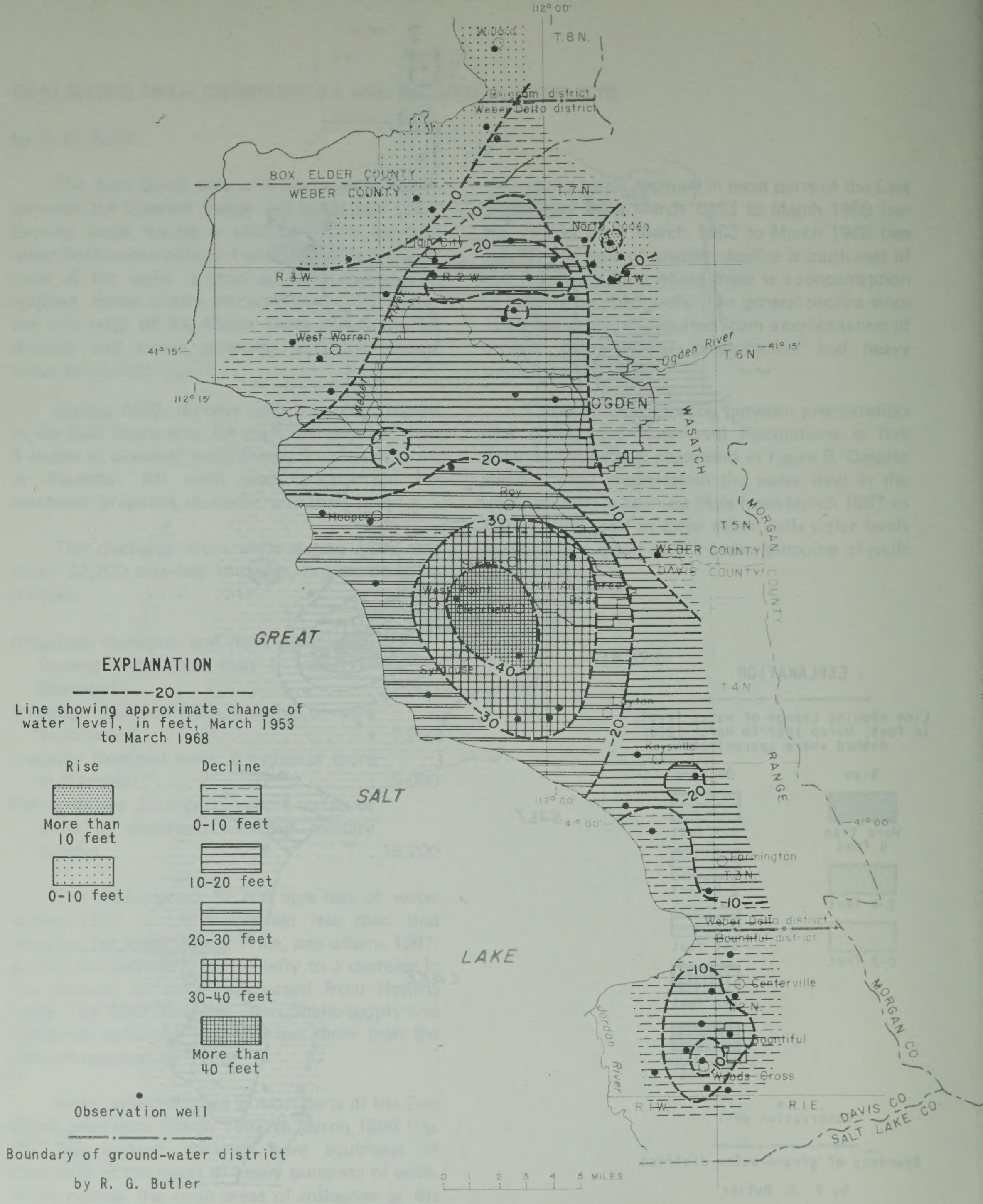


Figure 6.—Map of the East Shore area, Weber Delta and Bountiful districts, showing change of water levels from March 1967 to March 1968.



by R. G. Butler

Figure 7.—Map of the East Shore area, Weber Delta and Bountiful districts, showing change of water levels from March 1953 to March 1968.

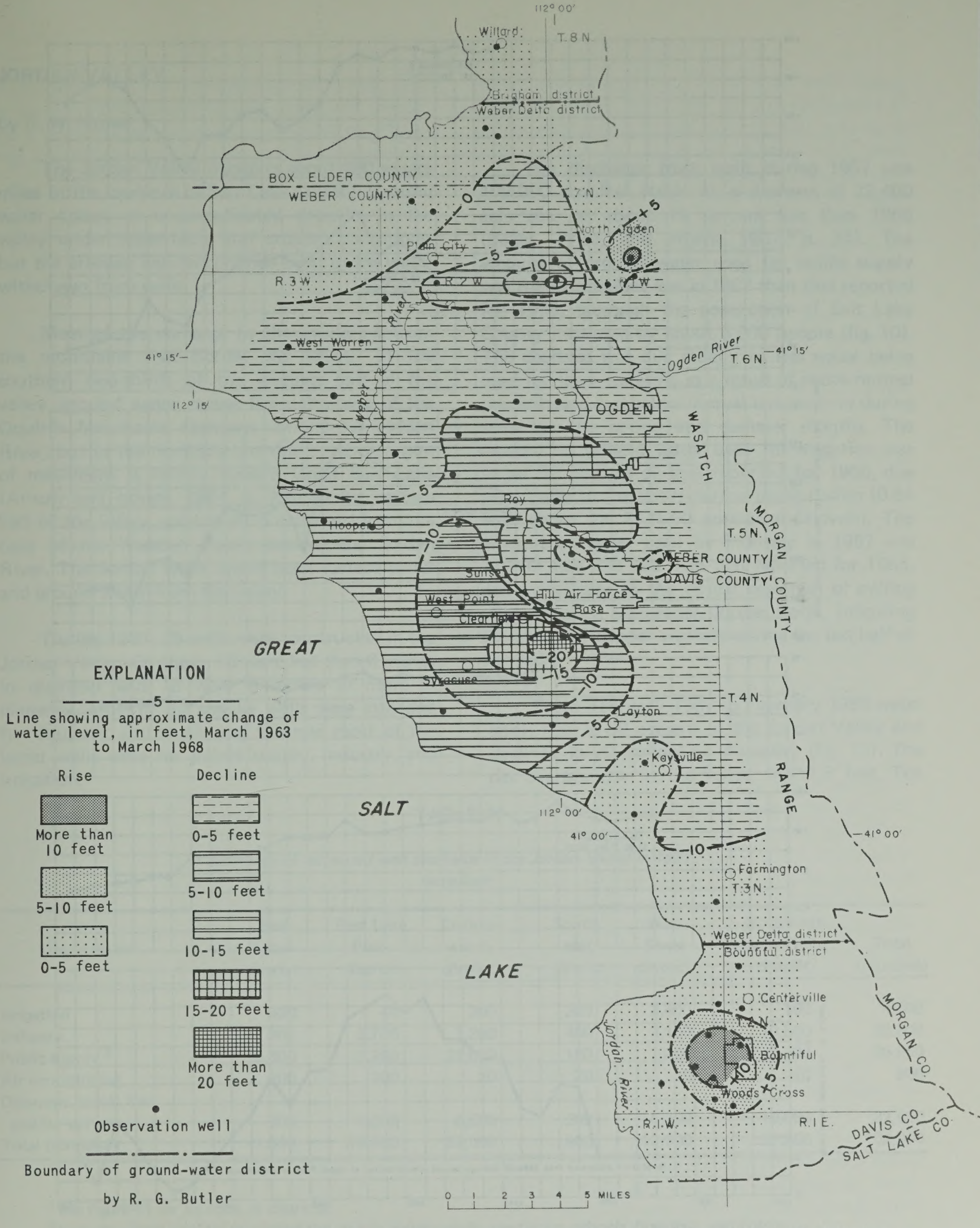


Figure 8.—Map of the East Shore area, Weber Delta and Bountiful districts, showing change of water levels from March 1963 to March 1968.

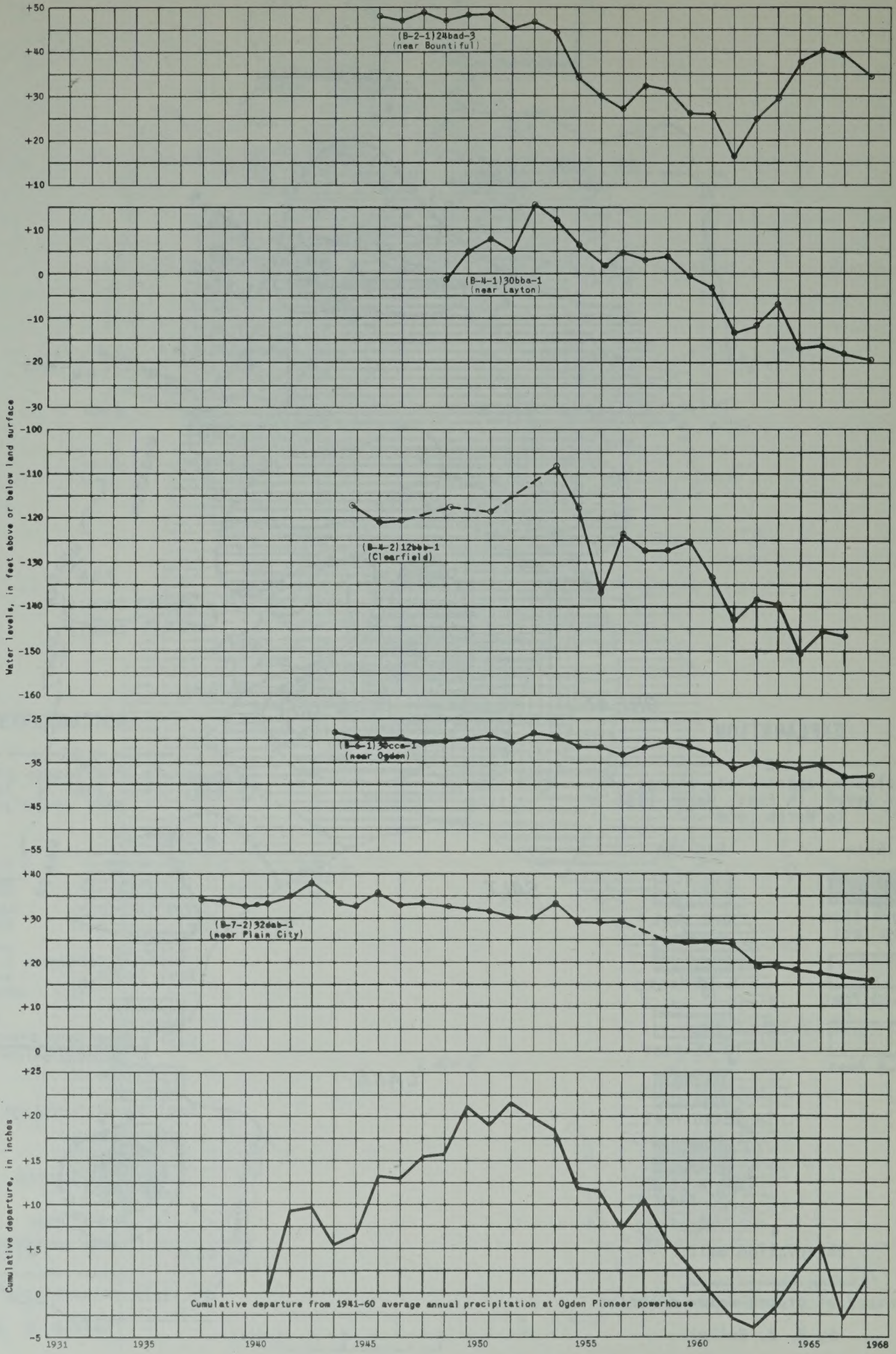


Figure 9.—Relation of water levels in wells near Bountiful, Layton, Clearfield, Ogden, and Plain City to cumulative departure from the average annual precipitation at Ogden Pioneer powerhouse.

JORDAN VALLEY

by R. W. Mower

The Jordan Valley occupies about 400 square miles in the lowlands of Salt Lake County. Ground water occurs in unconsolidated deposits in the valley under water-table and artesian conditions, but the artesian aquifers provide most of the water withdrawn from wells.

Most of the recharge to the aquifers is from the mountains that border the valley. In the southern two-thirds of the western half of the valley, ground water moves from the base of the Oquirrh Mountains eastward toward the Jordan River; but in the northern one-third, the direction of movement is mostly toward Great Salt Lake (Arnow and others, 1964, p. 28). In the eastern half of the valley, movement is westward from the base of the Wasatch Range toward the Jordan River. The Jordan River drains both surface water and ground water from the valley.

During 1967, 29 wells were constructed in the Jordan Valley. Of these, 13 were less than 6 inches in diameter and 16 were 6 inches or more in diameter. Most of the smaller wells were intended for domestic and stock use, whereas most of the larger wells were for public supply, industry, and irrigation.

The discharge from wells during 1967 was 102,900 acre-feet (table 4), a decrease of 23,400 acre-feet, or about 19 percent less than 1966 (Baker, Price, and others, 1967, p. 24). The amount of ground water used for public supply was 8,900 acre-feet less in 1967 than that reported for 1966, although the population of Salt Lake County increased by about 8,000 people (fig. 10). The decrease was due mainly to less water being used for lawn watering as a result of above-normal precipitation and below-normal temperature during most of the spring and summer months. The amount of ground water used for irrigation was about 60 percent of that reported for 1966, due principally to the above-normal precipitation (0.84 inch above the 1931-60 normal at Midvale). The amount of water used by industry in 1967 was 11,100 acre-feet less than that reported for 1966, due principally to the virtual cessation of milling operations by Kennecott Copper Corp., following the strike of copper workers during the last half of the year.

From February 1967 to February 1968 water levels rose in 80 percent of the Jordan Valley and declined in 20 percent of the valley (fig. 11). The net average rise in the valley was 1.5 feet. The

TABLE 4.

Summary of estimated well discharge in the Jordan Valley in 1967 [1]
(acre-feet)

Use of water	East Bench district	East Lake Plain district	Cotton-woods district	South-east district	West Slope district	Northwest Lake Plain district	Total (rounded)
Irrigation	500	40	200	200	3,400	100	4,400
Industry	900	3,700	1,200	400	3,100	19,500	28,800
Public supply [2]	5,800	3,200	22,600	100	1,000	3,200	35,900
Air conditioning	200	700	20	20	0	10	900
Domestic, stock, fish, and fur culture	200	9,000	8,500	200	5,000	10,000	32,900
Total (rounded)	7,600	16,600	32,500	900	12,500	32,800	102,900

[1] See figure 11 for location of districts.

[2] Includes water used by municipalities, public water supply companies, schools, hospitals, and hotels.

largest rises were in the southeastern part of the Cottonwoods district, the northeastern part of the Southeast district, and the southern part of the West Slope district. The largest declines were in a small area near the center of the valley where the East Lake Plain, Cottonwoods, and Northwest Lake Plain districts adjoin. The largest rises were in areas where pumpage was less and where recharge was greater than that in 1966. Rises in the southern part of the West Slope district probably reflect large quantities of irrigation water that infiltrated the ground from canals and fields because of the above-normal supplies of irrigation water.

Water levels rose in about half the valley during the principal pumping season between February and September 1967 (fig. 12) in contrast to rises in only about 15 percent of the valley between February and September 1966. The largest rises were in the area west of Riverton where rises in excess of 10 feet were observed. The largest seasonal declines, more than 10 feet, were in the Cottonwoods district where large quantities of water were pumped for public supply.

From February or March 1963 to February 1968 water levels rose in 60 percent of the Jordan Valley and declined in 40 percent of the valley (fig. 13). The net average change in water level over the valley was a rise of 2.9 feet. The largest rises, more than 15 feet, were in the southwestern part of the valley near Riverton and in the northeastern part of Salt Lake City. The largest declines, more than 5 feet, were near the southern part of Salt Lake City. The net rise of water levels occurred although withdrawals were at an alltime high for a 5-year period (fig. 10), probably because precipitation (fig. 14) and, therefore, recharge was much greater than it was during the previous 5 years.

The long-term relation between fluctuations of precipitation and water levels is illustrated in figure 14 by the graph showing the cumulative departure from normal annual precipitation at Silver Lake Brighton and hydrographs of the water levels in selected wells in the Jordan Valley. Precipitation during 1967 was 0.10 inch above normal, and this very small increase accounted for the nearly horizontal line in the precipitation graph. The above-normal precipitation and consequent diminished pumping are reflected by a rise of water levels in four of the five wells (see hydrographs in fig. 14).

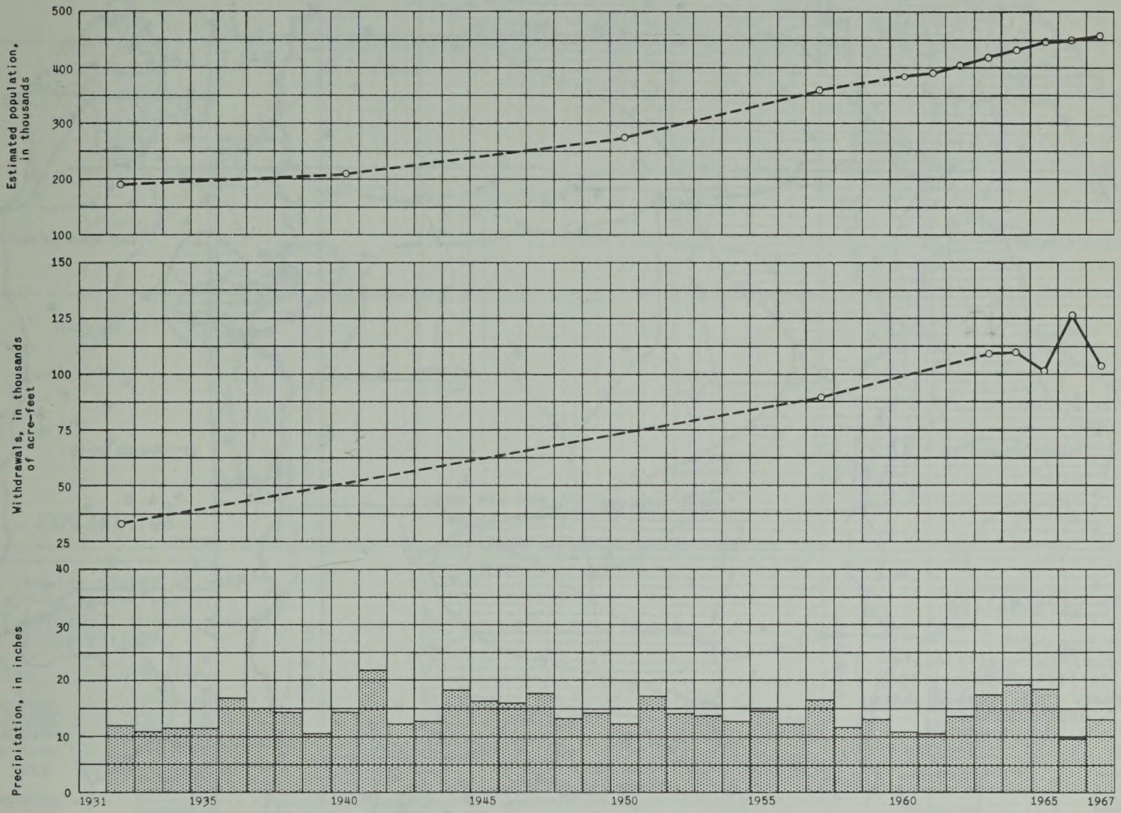


Figure 10.—Graphs showing estimated population of Salt Lake County, water withdrawn from wells, and annual precipitation at Midvale for the period 1932-67.

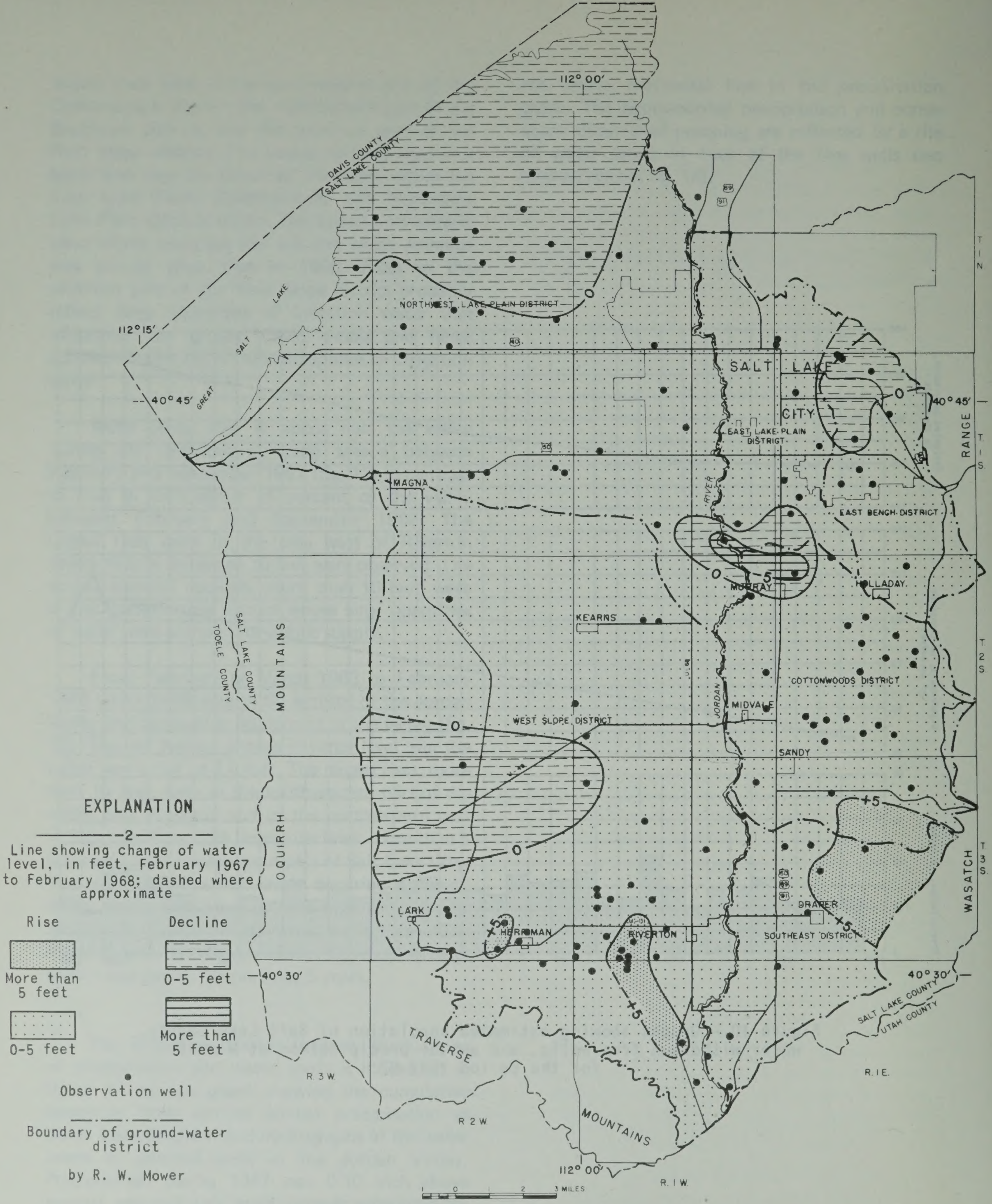


Figure 11.—Map of the Jordan Valley showing change of water levels from February 1967 to February 1968.

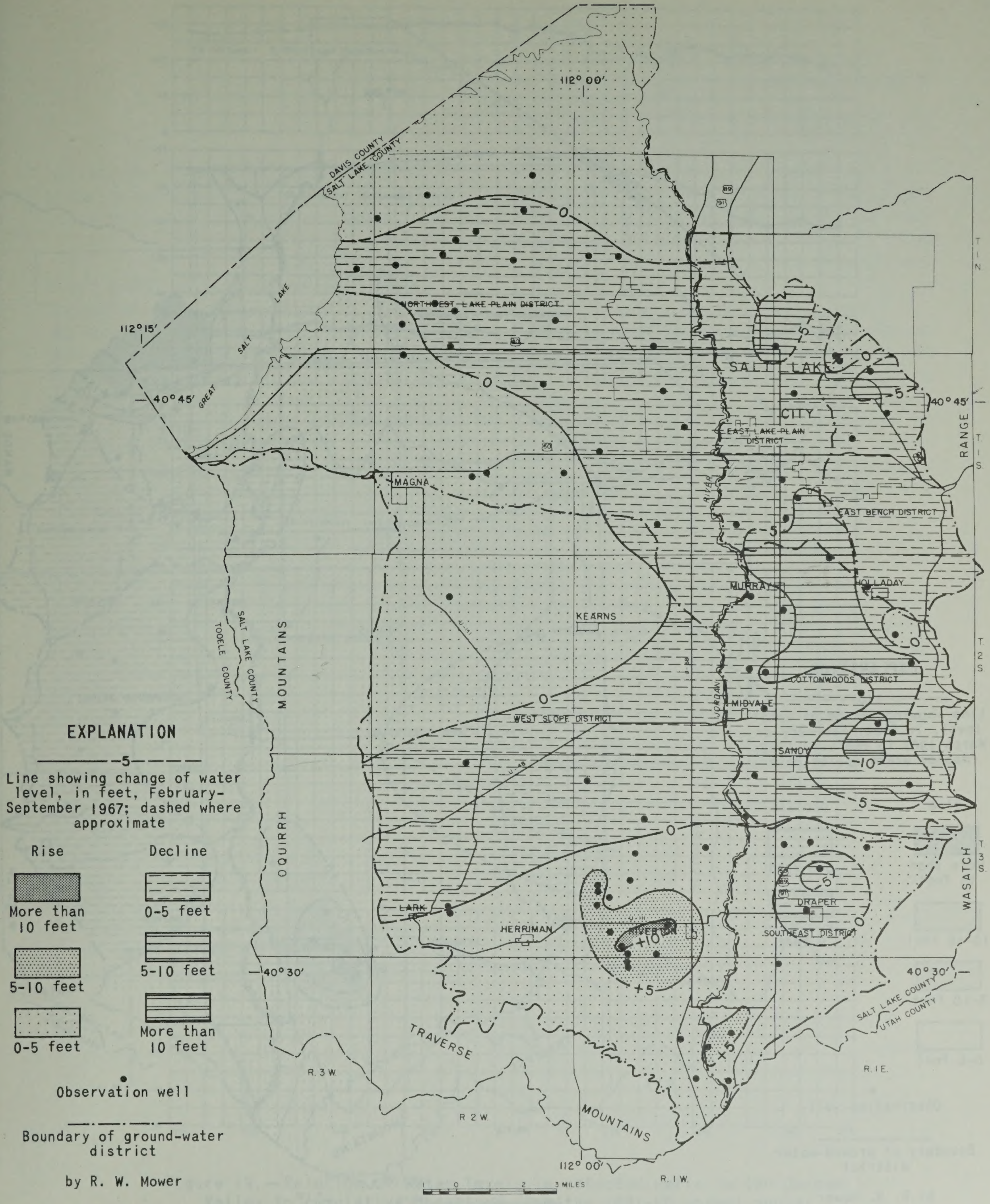


Figure 12.— Map of the Jordan Valley showing change of water levels from February to September 1967.

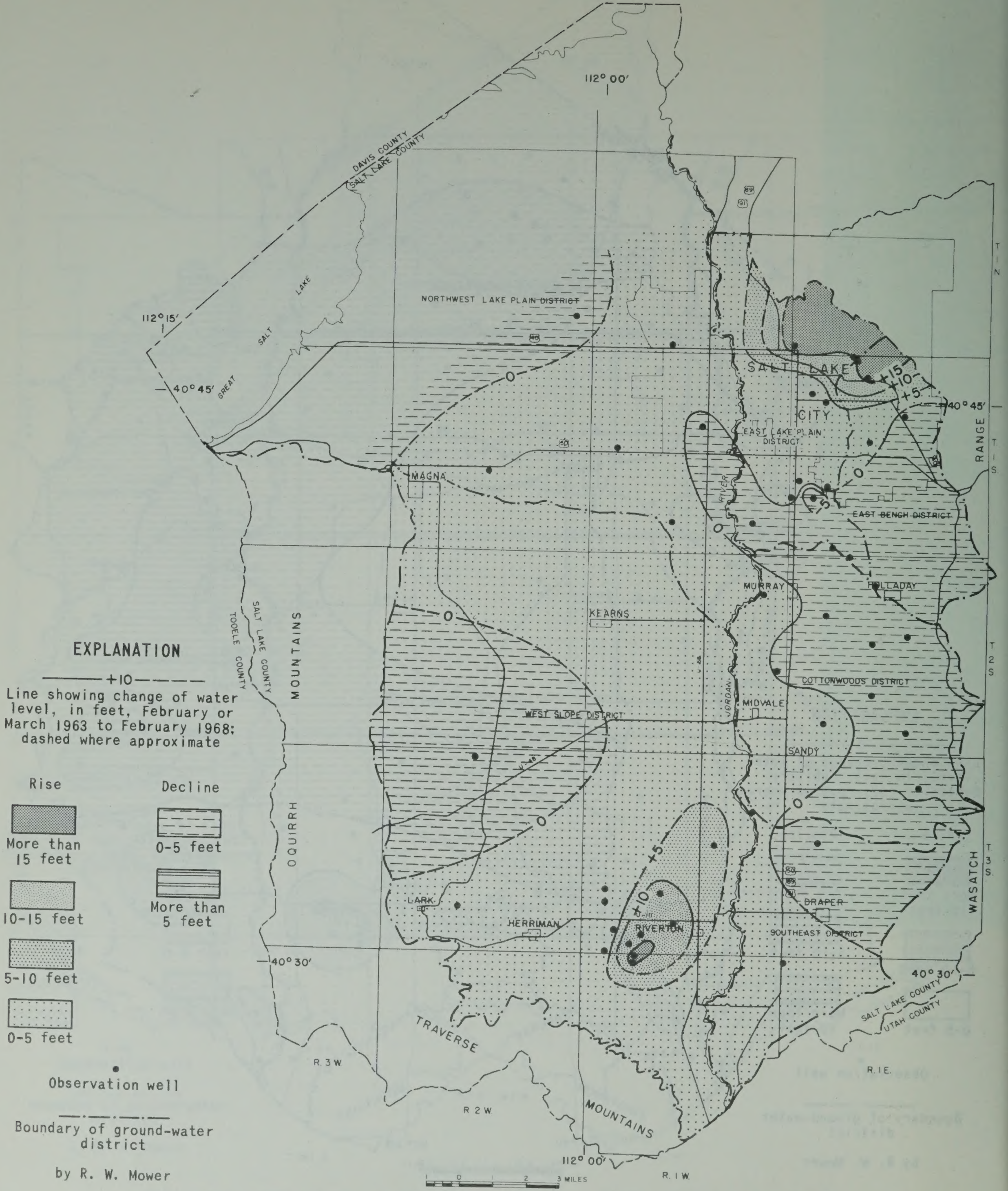


Figure 13.—Map of the Jordan Valley showing change of water levels from February or March 1963 to February 1968.

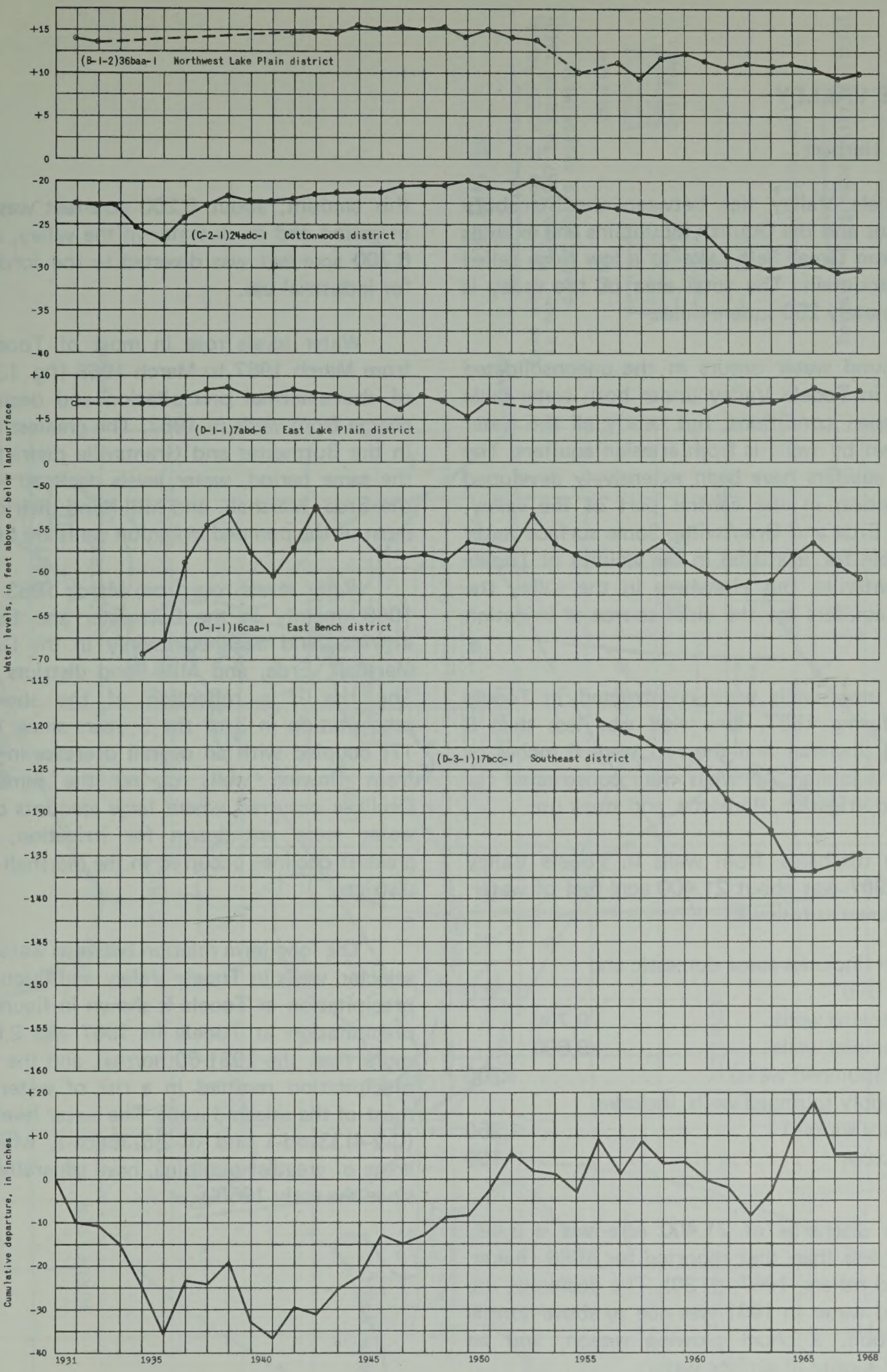


Figure 14.—Relation of water levels in selected wells in the Jordan Valley to cumulative departure from the 1931-60 normal annual precipitation at Silver Lake Brighton.

TOOELE VALLEY

by L. R. Herbert

Tooele Valley lies between the Stansbury Mountains and the Oquirrh Mountains and extends south from Great Salt Lake to a low ridge called South Mountain. The total area of the valley is approximately 250 square miles.

Ground water occurs in the unconsolidated deposits in Tooele Valley under both water-table and artesian conditions, but nearly all the water withdrawn by wells is from artesian aquifers. The artesian aquifers have been extensively developed for irrigation in the central part of the valley, between Erda and Grantsville. Some surface water is available for irrigation in the vicinity of Tooele and Grantsville, but elsewhere in the valley the artesian aquifers are the chief source of irrigation water.

Six new wells were constructed in Tooele Valley during 1967. One well was less than 6 inches in diameter and the rest were 6 inches or more in diameter. All wells were constructed for combined irrigation, domestic, and stock use.

The discharge from wells in Tooele Valley during 1967 was about 21,400 acre-feet of water, broken down as follows:

Irrigation (includes some domestic and stock use)		19,350
Flowing wells	9,750	
Pumped wells	9,600	
Industry (pumped wells)		700
Public supply (pumped wells, includes military supply)		1,250
Domestic use		100

The discharge of 21,400 acre-feet is 3,400 acre-feet less than that reported for 1966 (Baker, Price, and others, 1967, p. 30). The decreased use of ground water in 1967 was due to above-normal precipitation, a short growing season, and an increased supply of surface water.

The discharge from springs in Tooele Valley in 1967 was approximately 12,900 acre-feet. Of this amount, about 6,200 acre-feet was used for irrigation and stock water in the valley, and about 6,700 acre-feet was diverted to the Jordan Valley for industrial use.

Water levels rose in most of Tooele Valley from March 1967 to March 1968 (fig. 15) because of above-normal precipitation and decreased discharge from wells in 1967. The greatest rises were in the Burmester and Grantsville districts. During the same period, water levels declined in parts of the Erda, Marshall, and Mill Pond districts, where most of the pumped irrigation wells are located.

Water levels rose from March 1963 to March 1968, mainly in the Burmester and Lake Point districts, and declined mainly in the Grantsville, Marshall, Erda, and Mill Pond districts (fig. 16). The rise is a reflection of the above-normal precipitation in 3 of the 5 years since 1962 (fig. 17) coupled with an overall decrease in discharge from flowing wells during the same period. Declines occurred where large amounts of ground water were withdrawn for irrigation, and the greatest declines occurred in the Marshall and Erda districts.

The long-term relation between water levels in selected wells in Tooele Valley and fluctuations of precipitation at Tooele is shown in figure 17. The precipitation at Tooele in 1967 was 2.07 inches more than the 1931-60 normal, and the increased precipitation resulted in a rise of water levels in most of the selected wells. The water levels in wells (C-2-4)33add-1 and (C-2-6)36dcc-1, which are in areas of greatest pumping, have generally declined since the early 1950's.

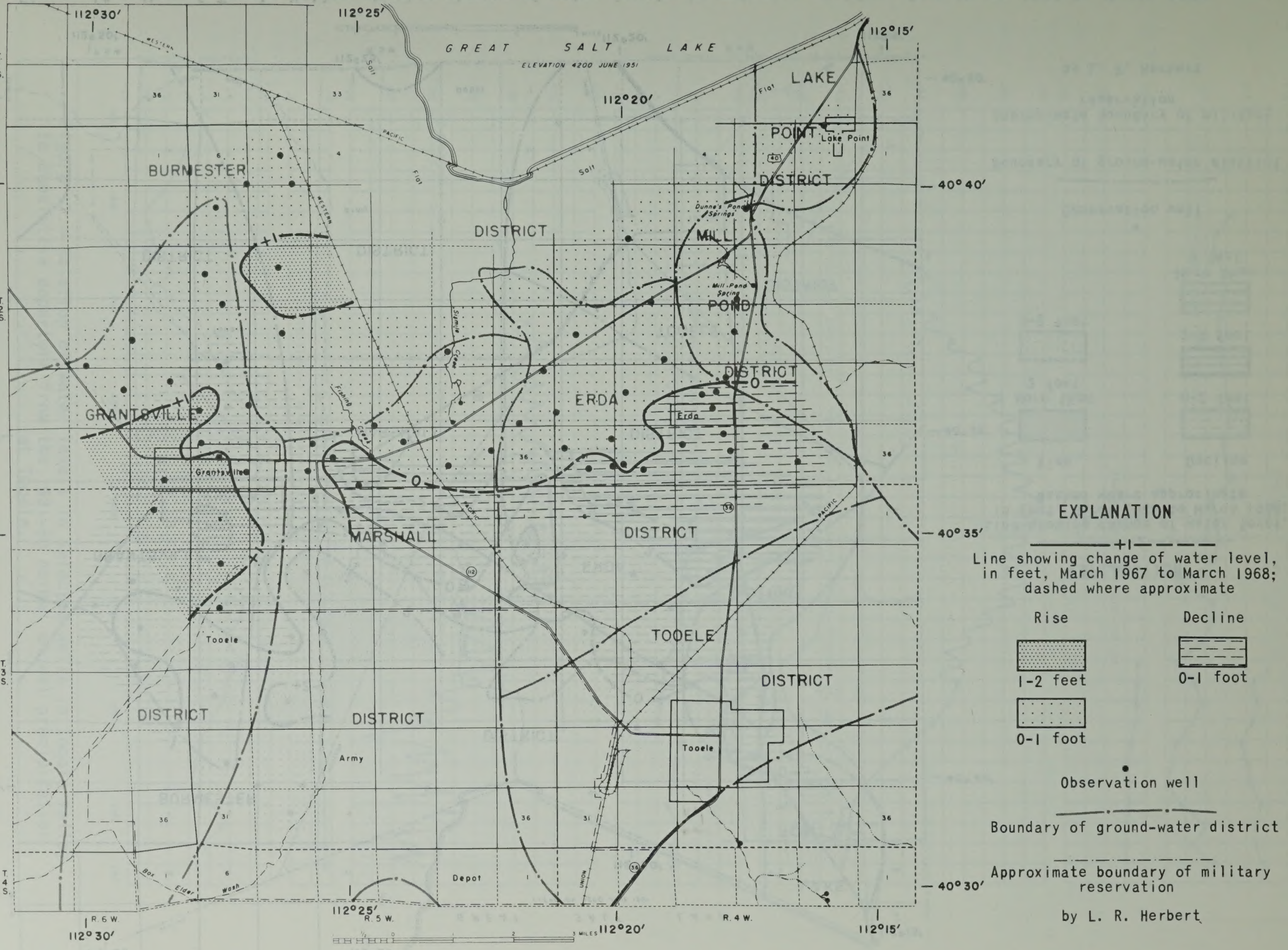


Figure 15.—Map of Tooele Valley showing change of water levels in artesian aquifers from March 1967 to March 1968.

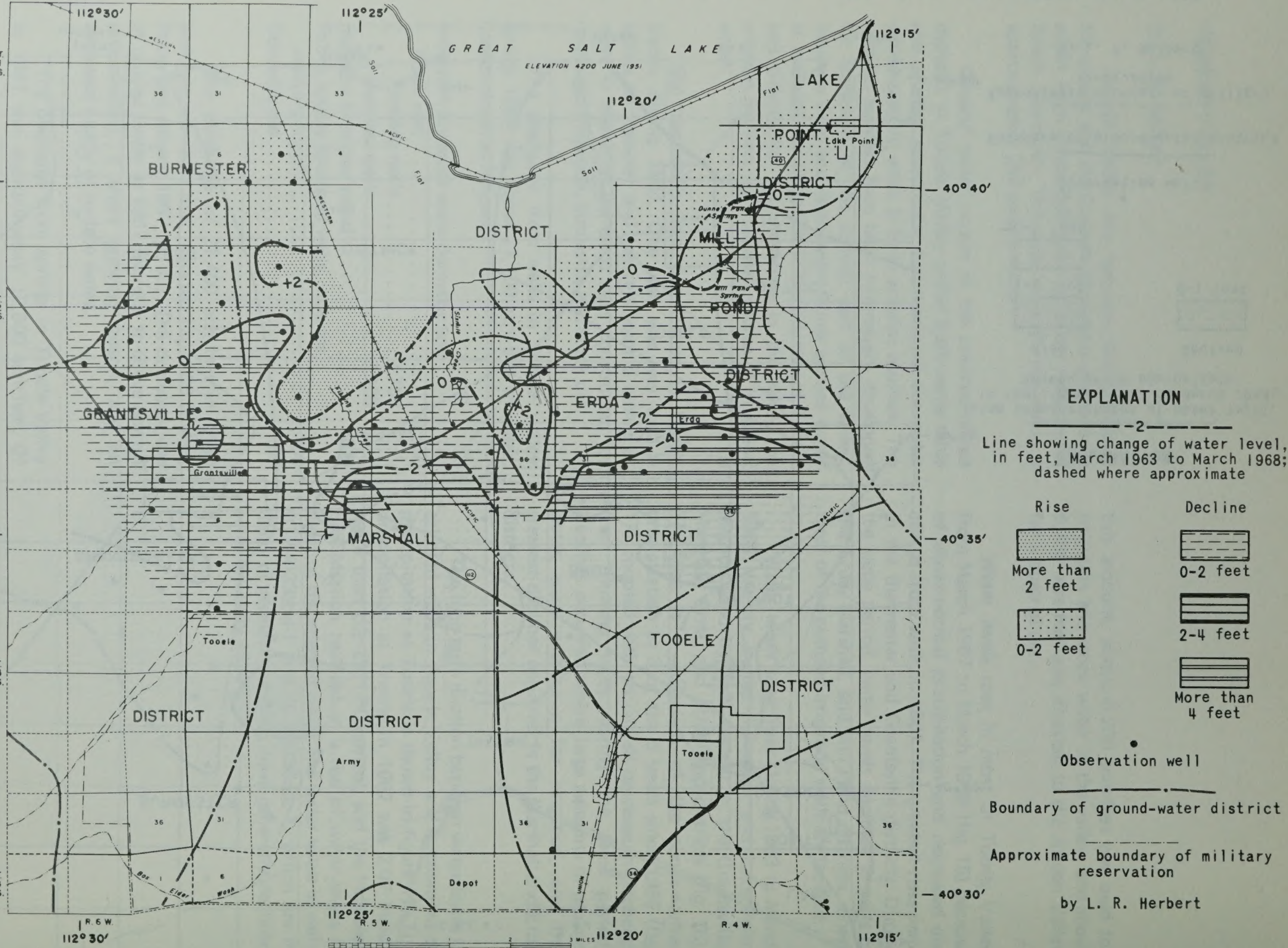


Figure 16.—Map of Tooele Valley showing change of water levels in artesian aquifers from March 1963 to March 1968.

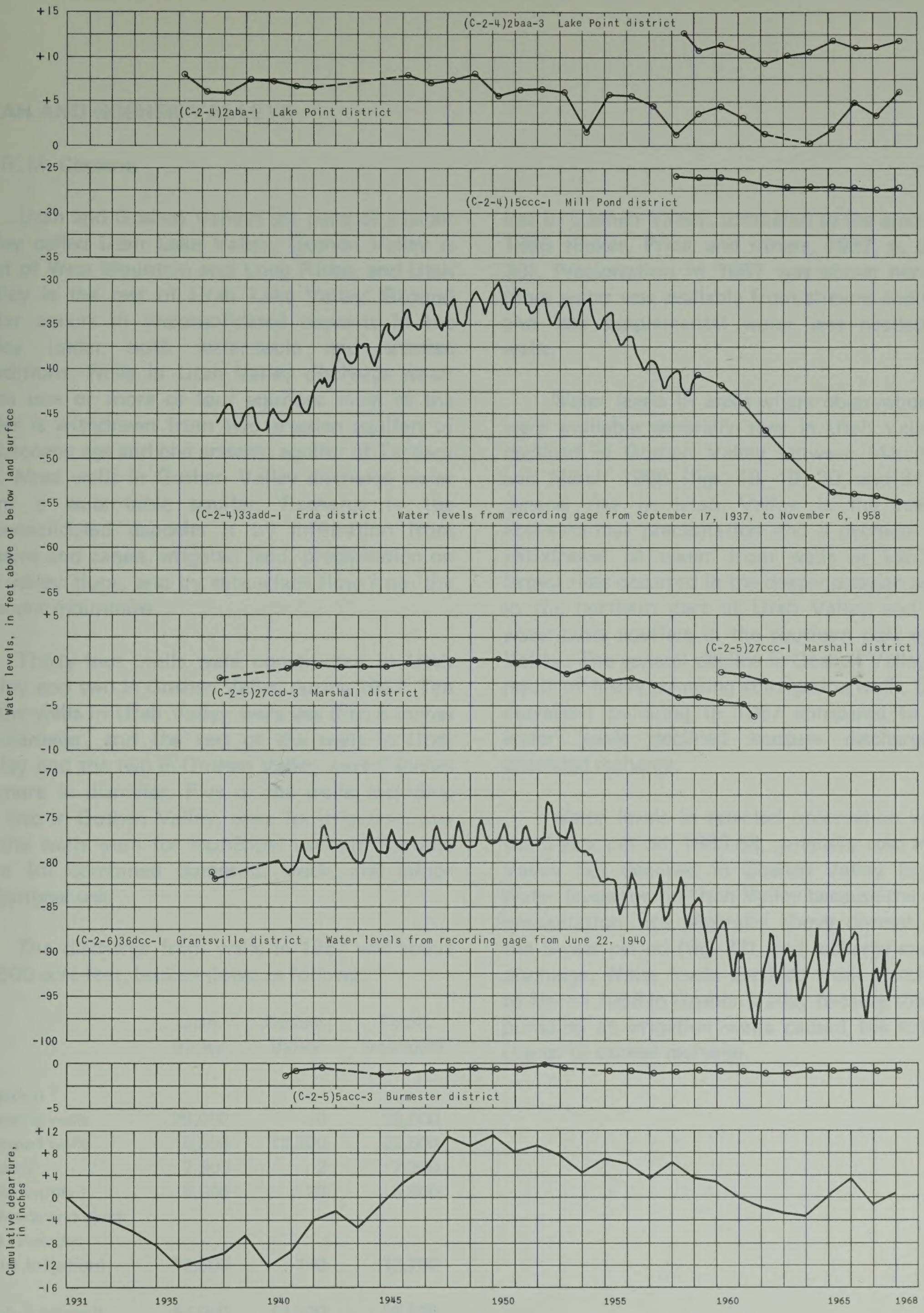


Figure 17.—Relation of water levels in selected wells in Tooele Valley to cumulative departure from the 1931-60 normal annual precipitation at Tooele.

UTAH AND GOSHEN VALLEYS

by R. M. Cordova

Utah and Goshen Valleys are parts of a larger valley called Utah Lake Valley. Goshen Valley is west of West Mountain and Long Ridge, and Utah Valley is the rest of Utah Lake Valley. Ground water occurs in unconsolidated deposits in the valley under both water-table and artesian conditions. Wells in Utah Valley discharge water from one or more of four aquifers. Most of the water is withdrawn from two artesian aquifers of Pleistocene age and one artesian aquifer of Tertiary age. Most wells in Goshen Valley discharge water from a water-table aquifer. Recharge to the unconsolidated deposits is by infiltration from streams and canals, irrigated land, precipitation on the valley floor, and by subsurface flow from the adjacent mountains.

Thirty-four wells were constructed in Utah Valley and two in Goshen Valley during 1967. Ten of the wells in Utah Valley were less than 6 inches in diameter, and the rest of the wells in Utah Valley and the two in Goshen Valley were 6 inches or more in diameter. Five of the wells, including the two in Goshen Valley, were for irrigation; two of the wells were for municipal use and the rest were for combined domestic, stock, and minor irrigational use.

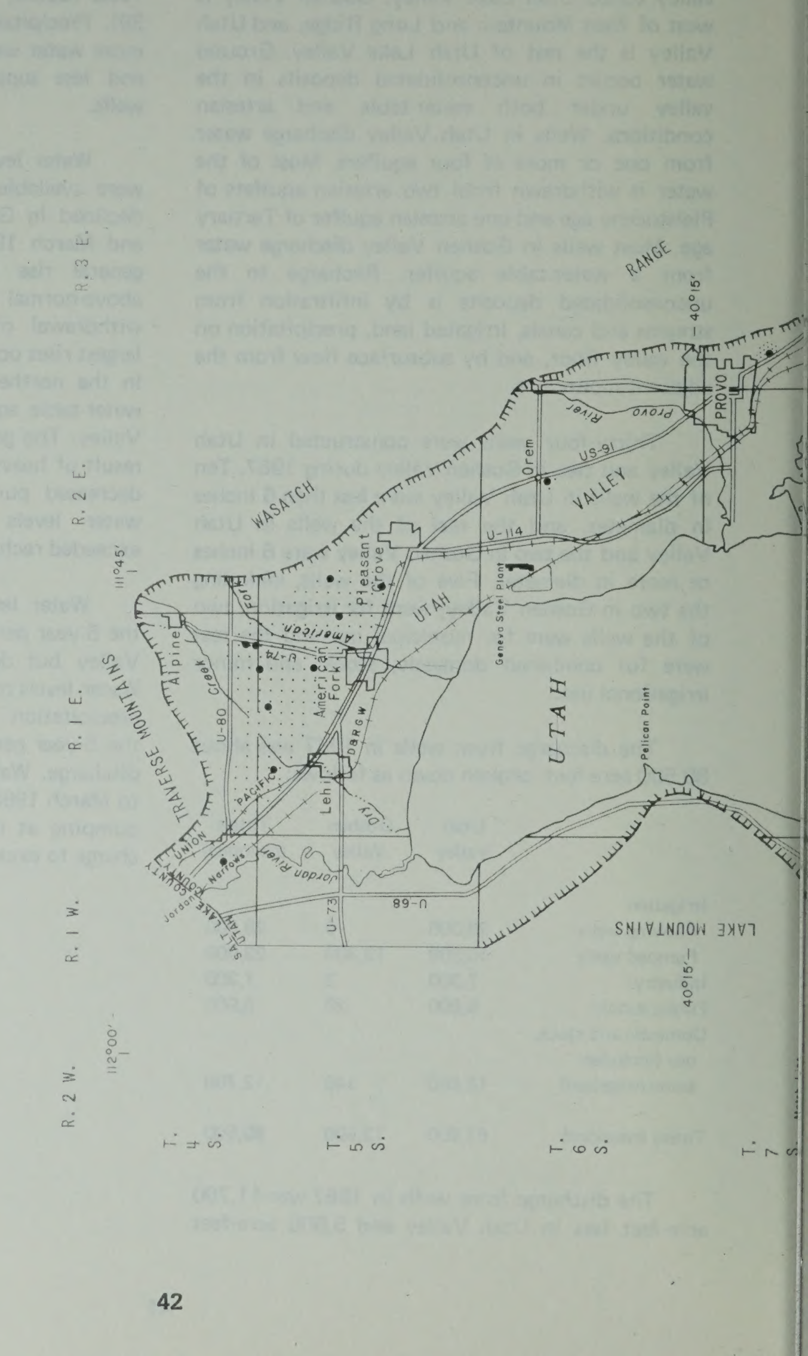
The discharge from wells in 1967 was about 80,500 acre-feet, broken down as follows:

	Utah Valley	Goshen Valley	Totals (rounded)
Irrigation			
Flowing wells	28,000	0	28,000
Pumped wells	10,300	13,300	23,600
Industry	7,300	2	7,300
Public supply	8,900	20	8,900
Domestic and stock use (includes some irrigation)	12,600	140	12,700
Totals (rounded)	67,000	13,500	80,500

The discharge from wells in 1967 was 11,700 acre-feet less in Utah Valley and 5,600 acre-feet less in Goshen Valley, compared to the amounts in 1966 (Baker, Price, and others, 1967, p. 33 and 39). Precipitation in 1967 was above normal so more water was available from streams and springs and less supplemental water was needed from wells.

Water levels in areas where observation wells were available generally rose in Utah Valley but declined in Goshen Valley between March 1967 and March 1968 (figs. 18, 19, 20, and 21). The general rise in Utah Valley is the result of above-normal precipitation and a decrease in the withdrawal of water from wells in 1967. The largest rises occurred in the deeper artesian aquifers in the northern part of Utah Valley and in the water-table aquifers in the southern part of Utah Valley. The general decline in Goshen Valley is the result of heavy pumping at irrigation wells. Despite decreased pumping in 1967 compared to 1966, water levels declined because discharge still exceeded recharge.

Water levels in selected observation wells in the 5-year period, 1963-68, generally rose in Utah Valley but declined in Goshen Valley (fig. 22). Water levels rose in Utah Valley because the annual precipitation was generally above normal during the 5-year period (fig. 23), and recharge exceeded discharge. Water levels declined from March 1963 to March 1968 in Goshen Valley because the heavy pumping at irrigation wells caused the total discharge to exceed recharge.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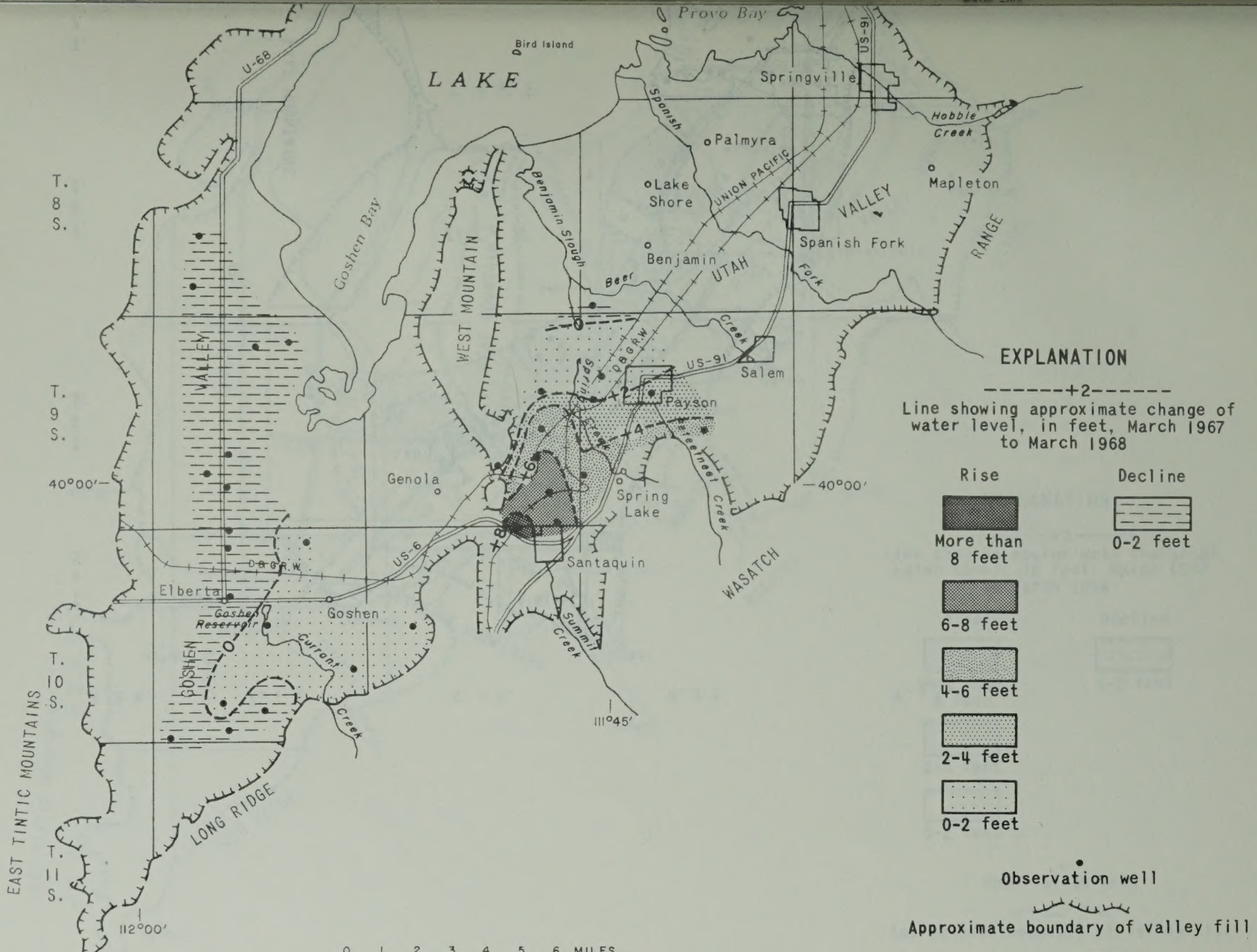
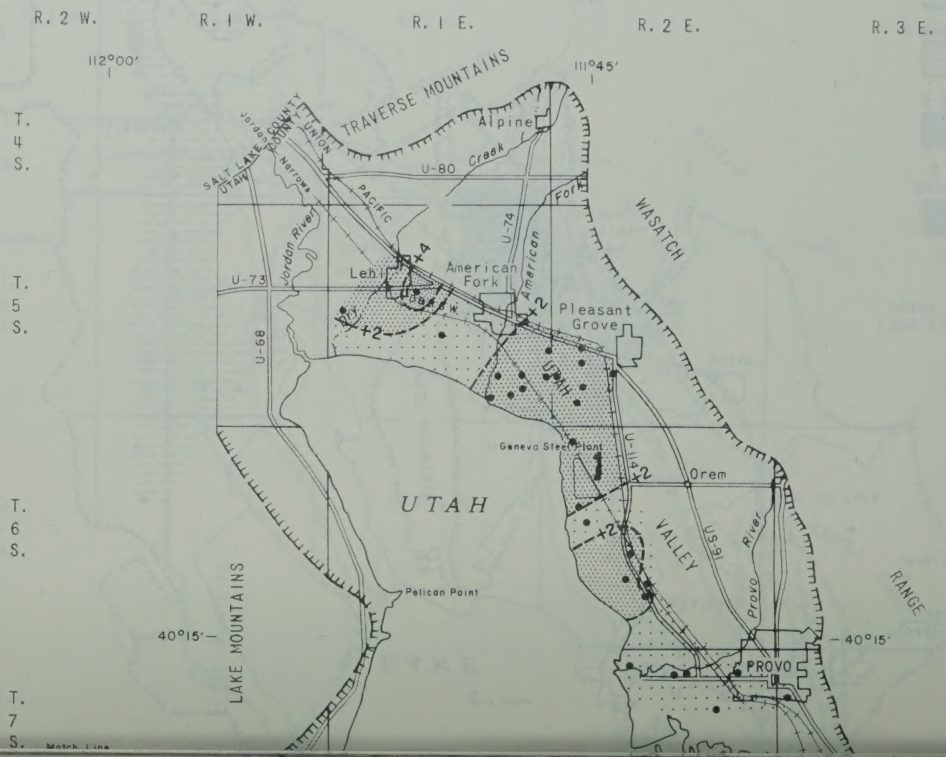


by R. M. Cordova

Figure 18.—Map of Utah and Goshen Valleys showing change of water levels in the water-table aquifers, March 1967 to March 1968.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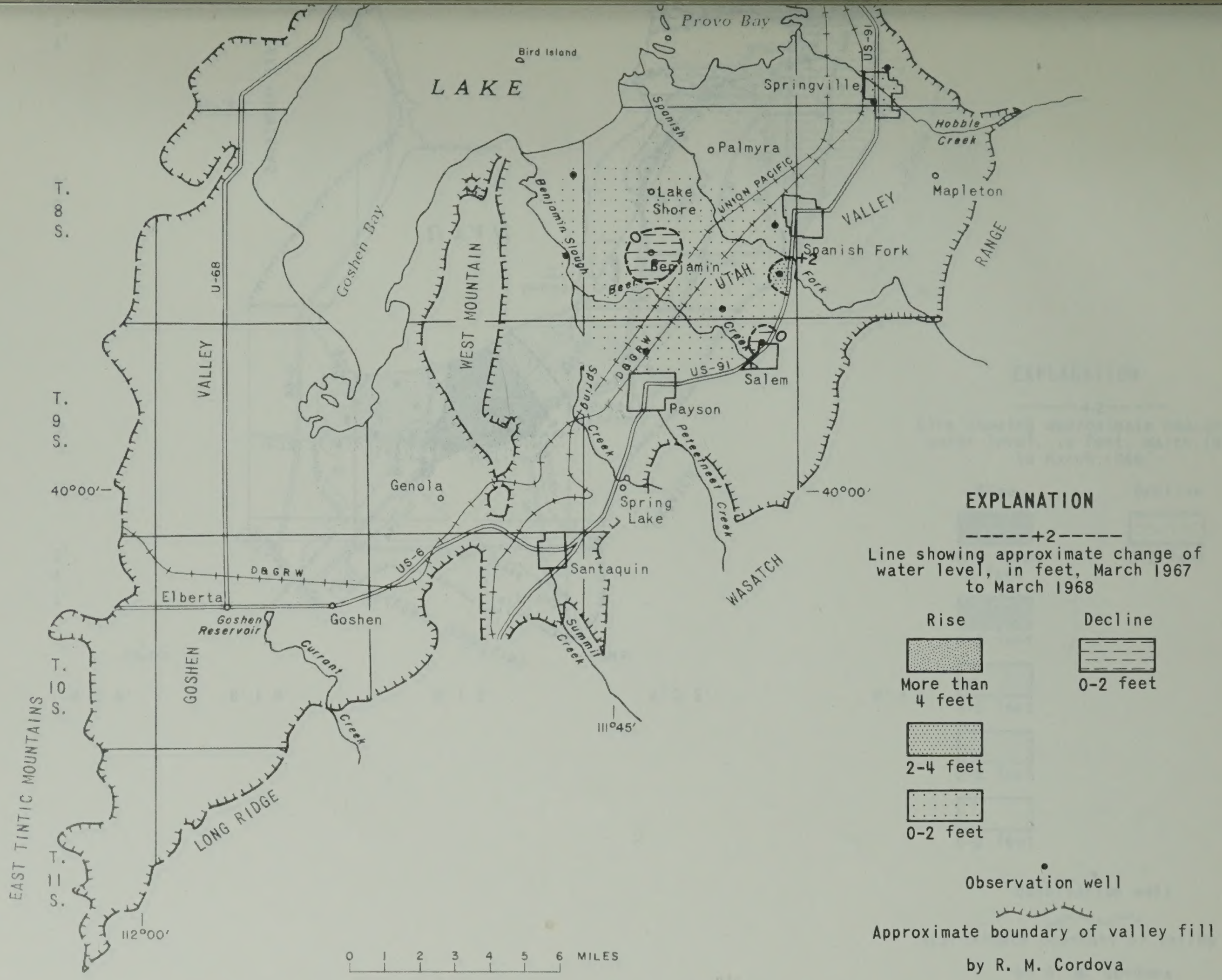
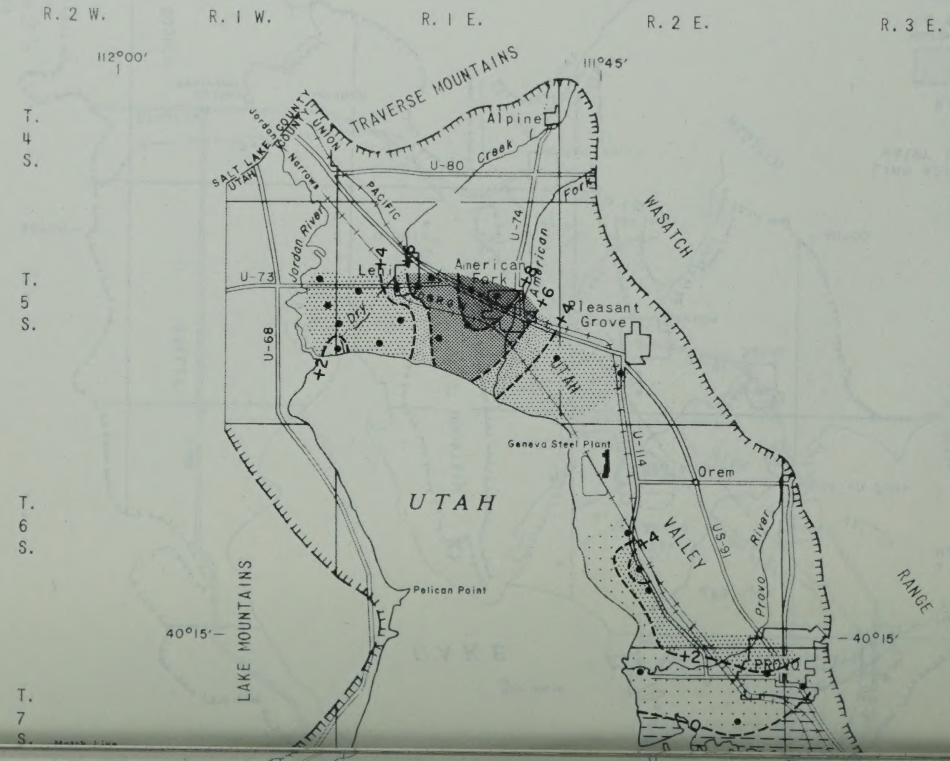


Figure 19.—Map of Utah and Goshen Valleys showing change of water levels in the shallow artesian aquifer in rocks of Pleistocene age from March 1967 to March 1968.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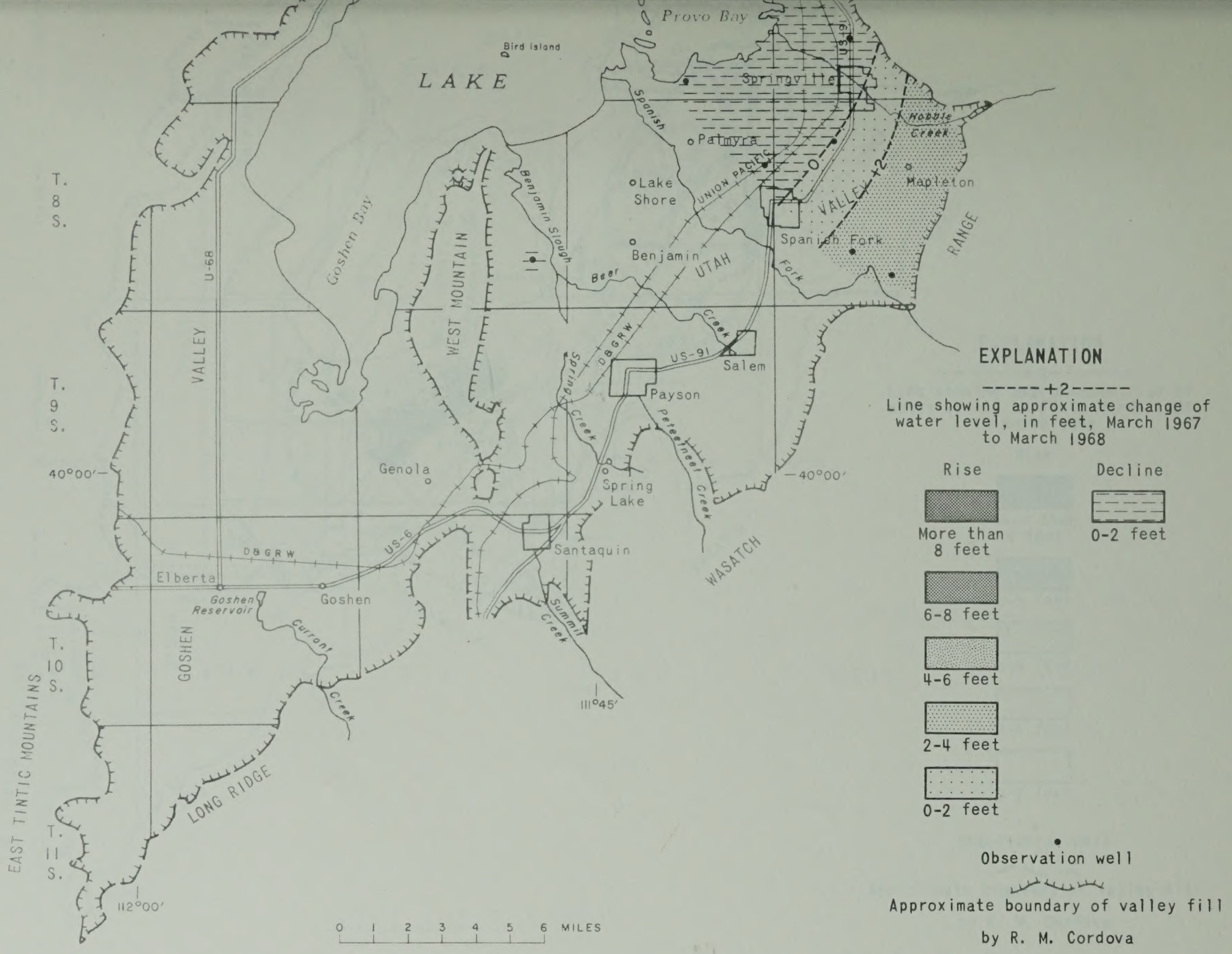
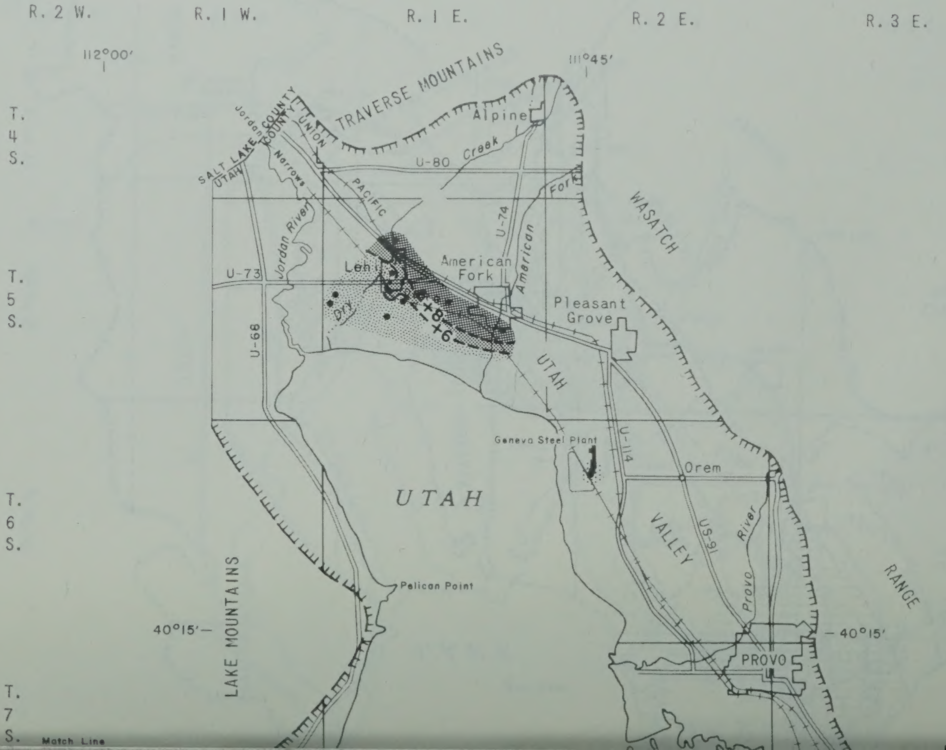


Figure 20.—Map of Utah and Goshen Valleys showing change of water levels in the deep artesian aquifer in rocks of Pleistocene age from March 1967 to March 1968.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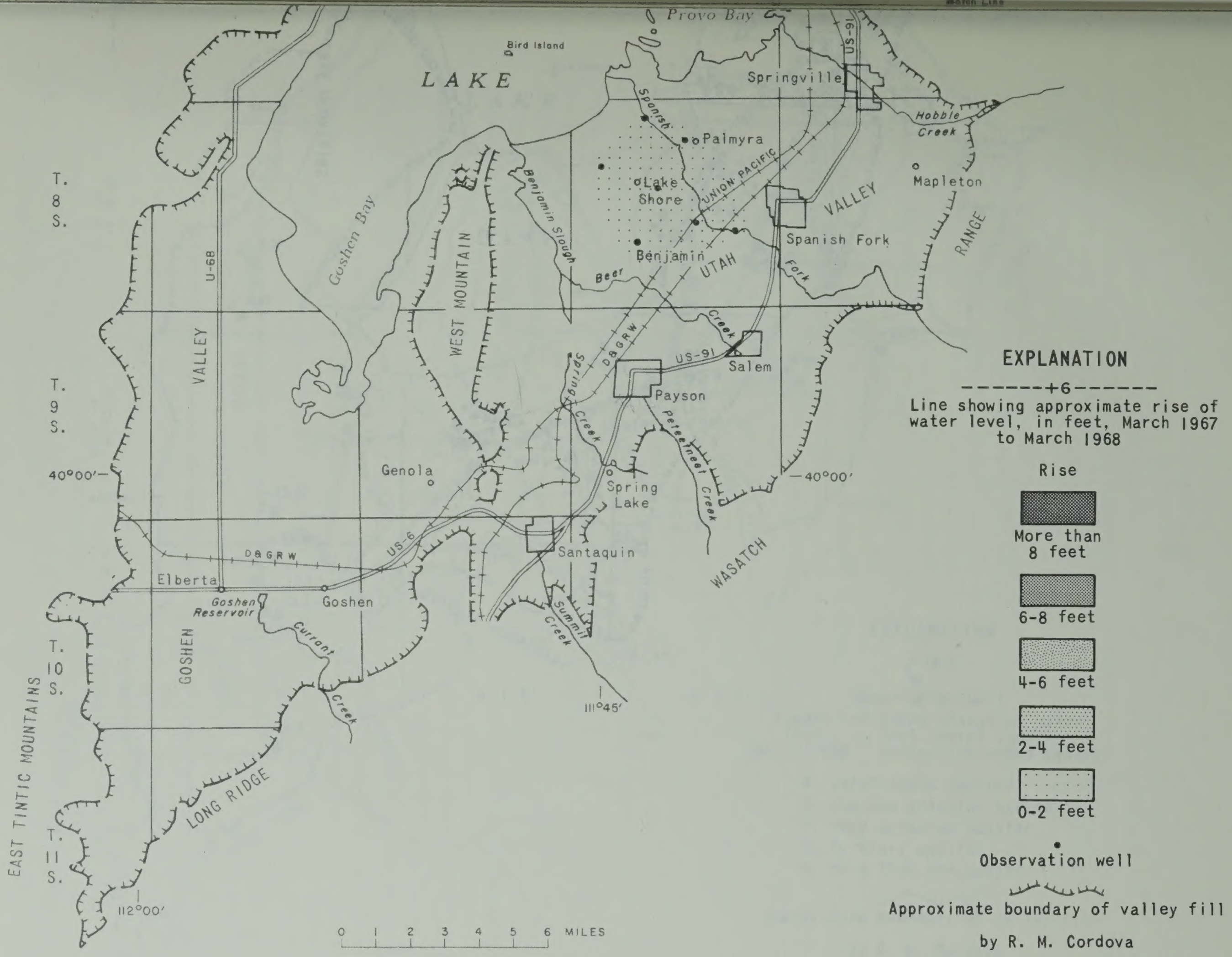
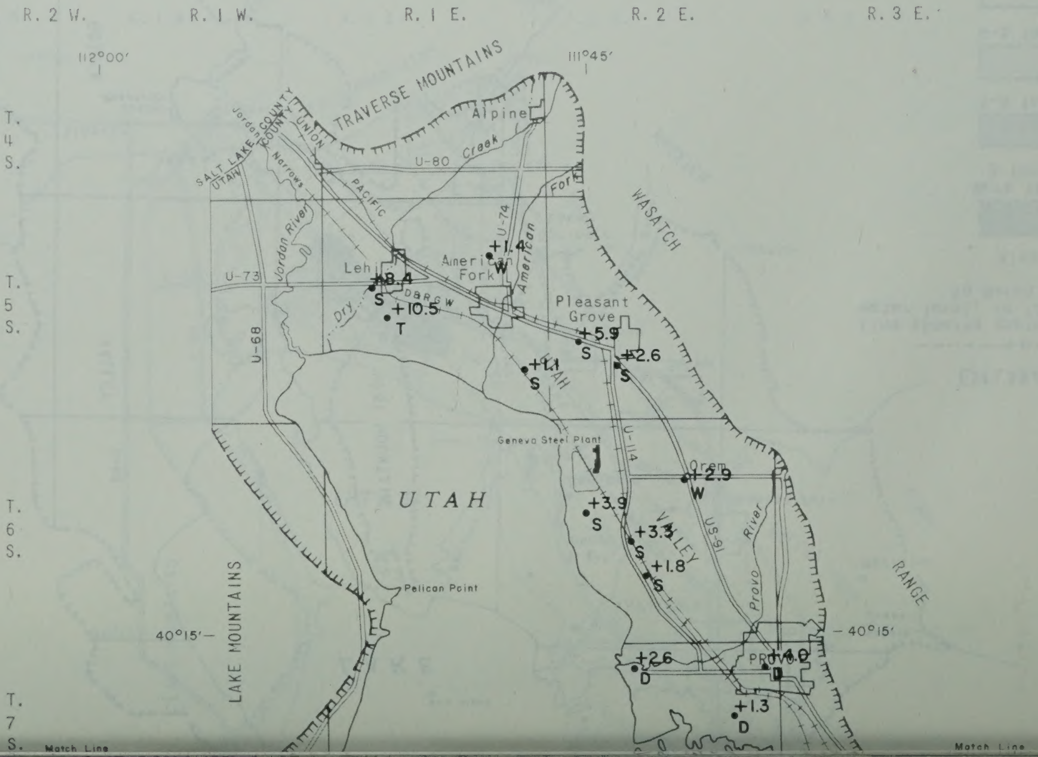


Figure 21.—Map of Utah and Goshen Valleys showing change of water levels in the artesian aquifer in rocks of Tertiary age, March 1967 to March 1968.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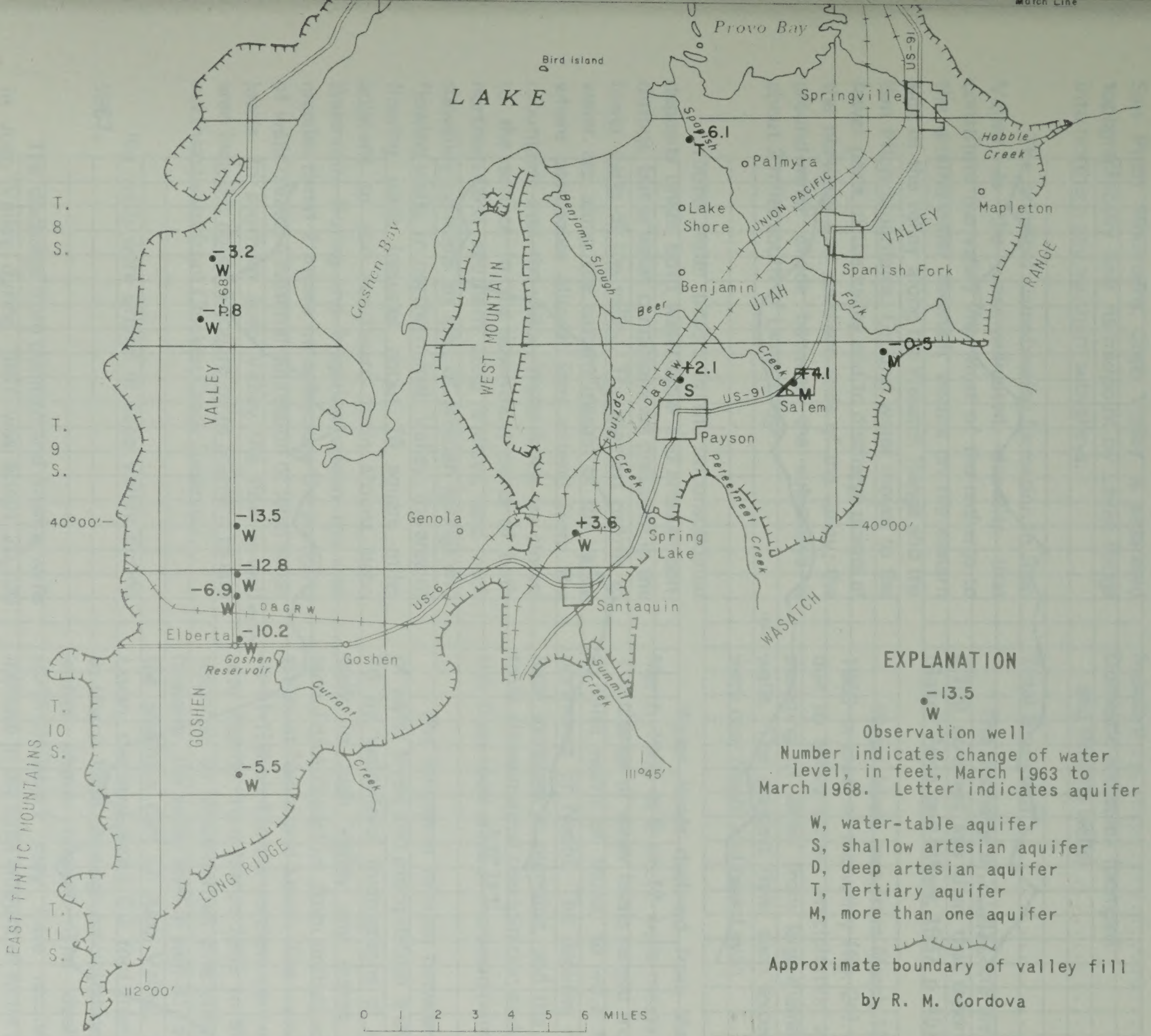


Figure 22.—Map of Utah and Goshen Valleys showing change of water levels from March 1963 to March 1968.

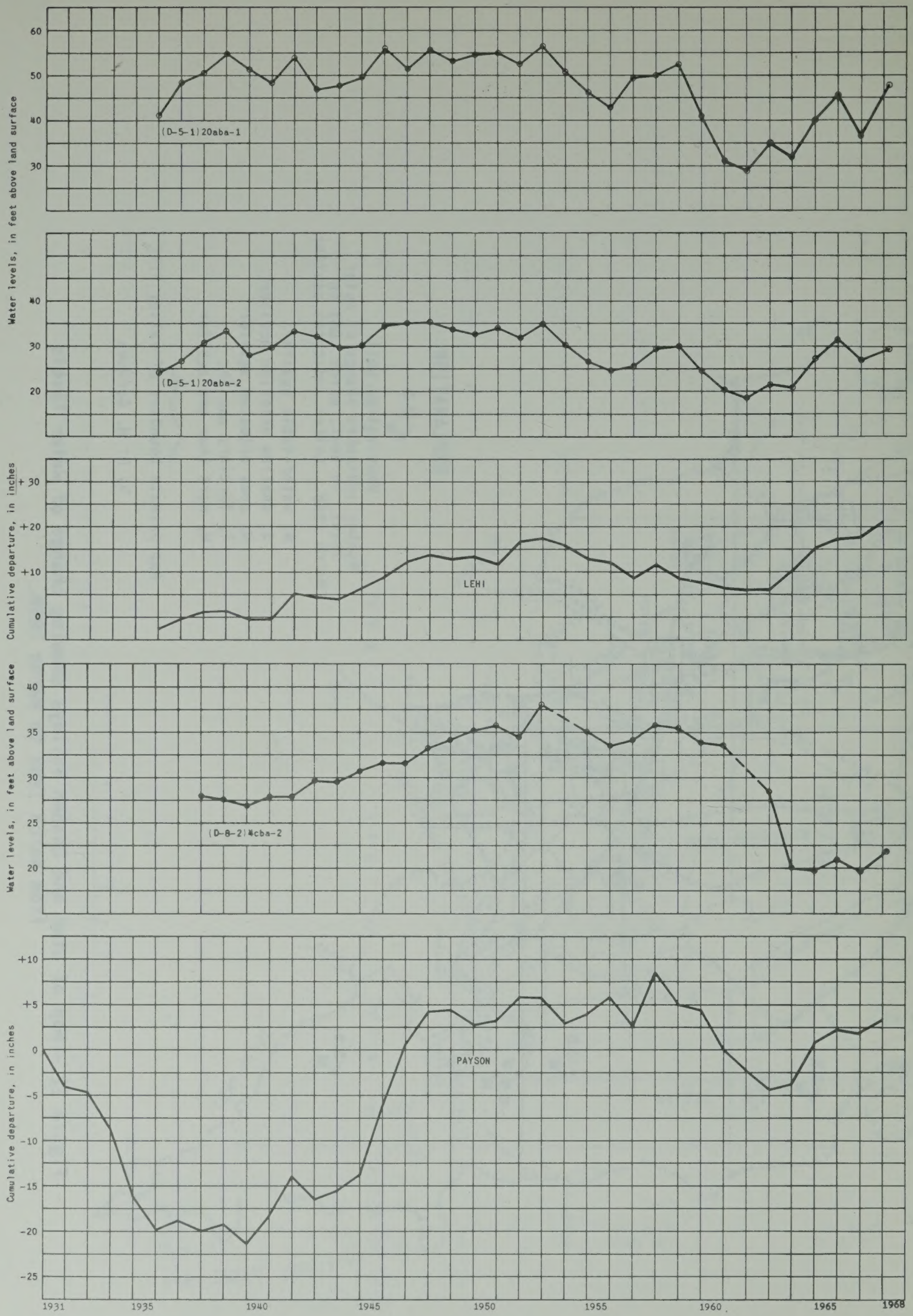


Figure 23.—Relation of water levels in selected observation wells to cumulative departure from the 1931-60 normal annual precipitation at Utah Lake Lehi and Payson.

JUAB VALLEY

by R. G. Butler

Juab Valley, which is about 40 miles long and averages about 4 miles wide, is in central Utah along the west side of the Wasatch Range and the San Pitch Mountains. Juab Valley is separated topographically near its midpoint by Levan Ridge into northern and southern subvalleys.

The principal water-bearing formation in Juab Valley is the unconsolidated deposits that constitute the valley fill. Most of the recharge to the ground-water reservoir occurs on the eastern side of the valley along the Wasatch Range and the San Pitch Mountains. Ground water moves to the lower parts of the valley and to discharge points at the northern and southern ends of the valley; the ground-water divide between the subvalleys is about 2 miles south of Levan Ridge.

Ground water occurs in the unconsolidated deposits under both water-table and artesian conditions, but artesian conditions are prevalent in the lower parts of the valley. The greatest depths to water are along the eastern margin of the valley where permeable alluvial fans extend from the mountains into the valley. Water levels are closest to the surface in the lowermost parts of both northern and southern Juab Valleys, and each subvalley contains an area of artesian springs and flowing wells. In northern Juab Valley, the area of flowing wells includes about 10 square miles adjacent to and southward from Mount Nebo Reservoir. During the irrigation season the area recedes about 2 square miles because the pumping of wells creates a seasonal depression of local water levels. In southern Juab Valley the flowing-well area includes about 6 square miles adjacent to and northeastward from Chicken Creek Reservoir.

No wells were drilled in Juab Valley during 1967.

The discharge from pumped and flowing wells in Juab Valley during 1967 was about 20,700 acre-feet of water, broken down as follows:

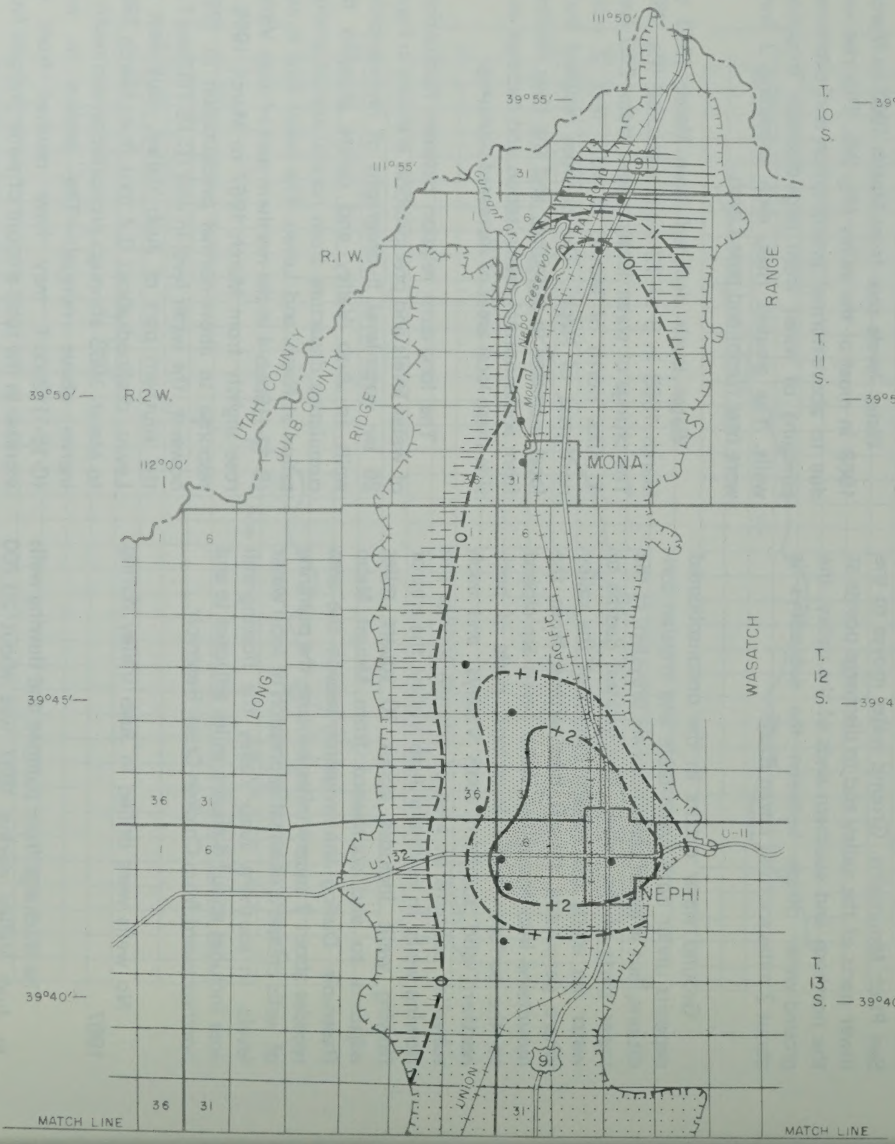
Irrigation	
Pumped wells	17,500
Flowing wells	3,000
Industry	50
Domestic and stock (pumped and flowing wells)	150
Total (rounded)	20,700

The discharge of 20,700 acre-feet in 1967 was 4,700 acre-feet less than that reported for 1966 (Baker, Price, and others, 1967, p. 45).

Water levels rose from March 1967 to March 1968 in most of the valley (fig. 24). This rise was due to above-normal precipitation and decreased pumping of water from large-diameter irrigation wells. The greatest rises, each exceeding 2 feet, were near Nephi and near Levan.

Water levels declined from March 1963 to March 1968 in 8 of 12 wells measured (fig. 25). The change of water levels ranged from -7.97 feet, 4 miles north of Mona, to +6.7 feet, 2 miles northwest of Nephi. The declines resulted from local increases in pumping, and the rises resulted from above-normal precipitation and recharge outside these local areas of increased pumping.

The long-term relation between fluctuations of water levels and precipitation is shown in figure 26 by water-level hydrographs of representative wells in Juab Valley and curves showing the cumulative departure from normal annual precipitation at Nephi and Levan. The water level in well (D-11-1)9bbb-4 in the northern part of Juab Valley rose slightly from March 1967 to March 1968 in response to above-normal precipitation in 1967; however, the water level in well (C-15-1)12aba-1 in the southern part of Juab Valley, southwest of Levan, declined about 0.2 foot from March 1967 to March 1968 although precipitation was nearly 3 inches above normal. The decline in well (C-15-1)12aba-1 may have resulted from an increase in the total amount of water pumped from large-diameter wells southwest of Levan.


R.1 E.
111°50′
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T. 10 S.
—39°55′
111°55′
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31
6
Current Cr.
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RAILROAD
Mount Nebo Reservoir
R.1 W.
RANGE
T. 11 S.
—39°50′
39°50′—
R.2 W.
UTAH COUNTY
JUAB COUNTY
RIDGE
112°00′
1
MONA
36
31
1
6
0
PACIFIC
WASATCH
T. 12 S.
—39°45′
39°45′—
LONG
+1
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36
31
36
U-11
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U-132
NEPHI
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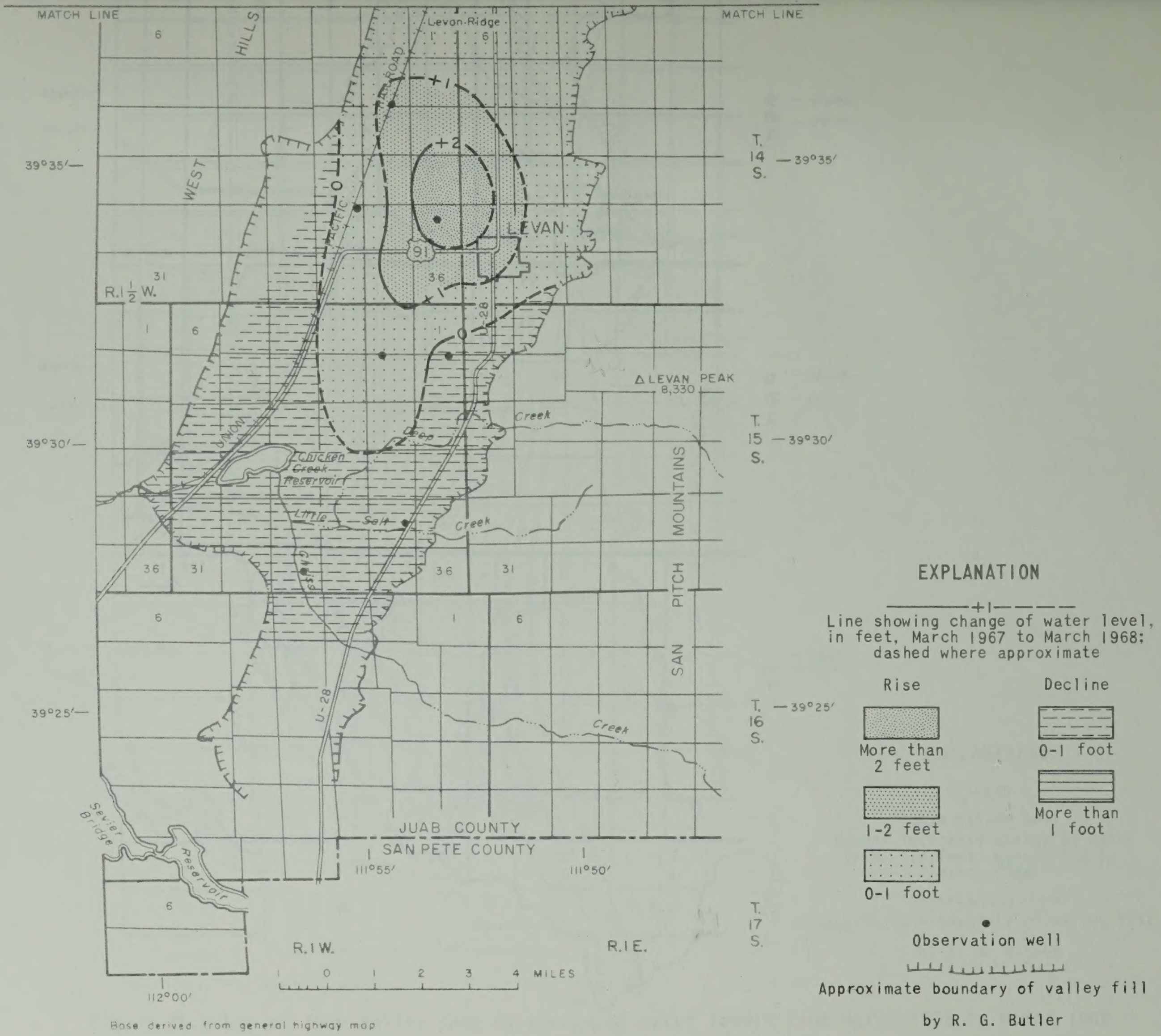
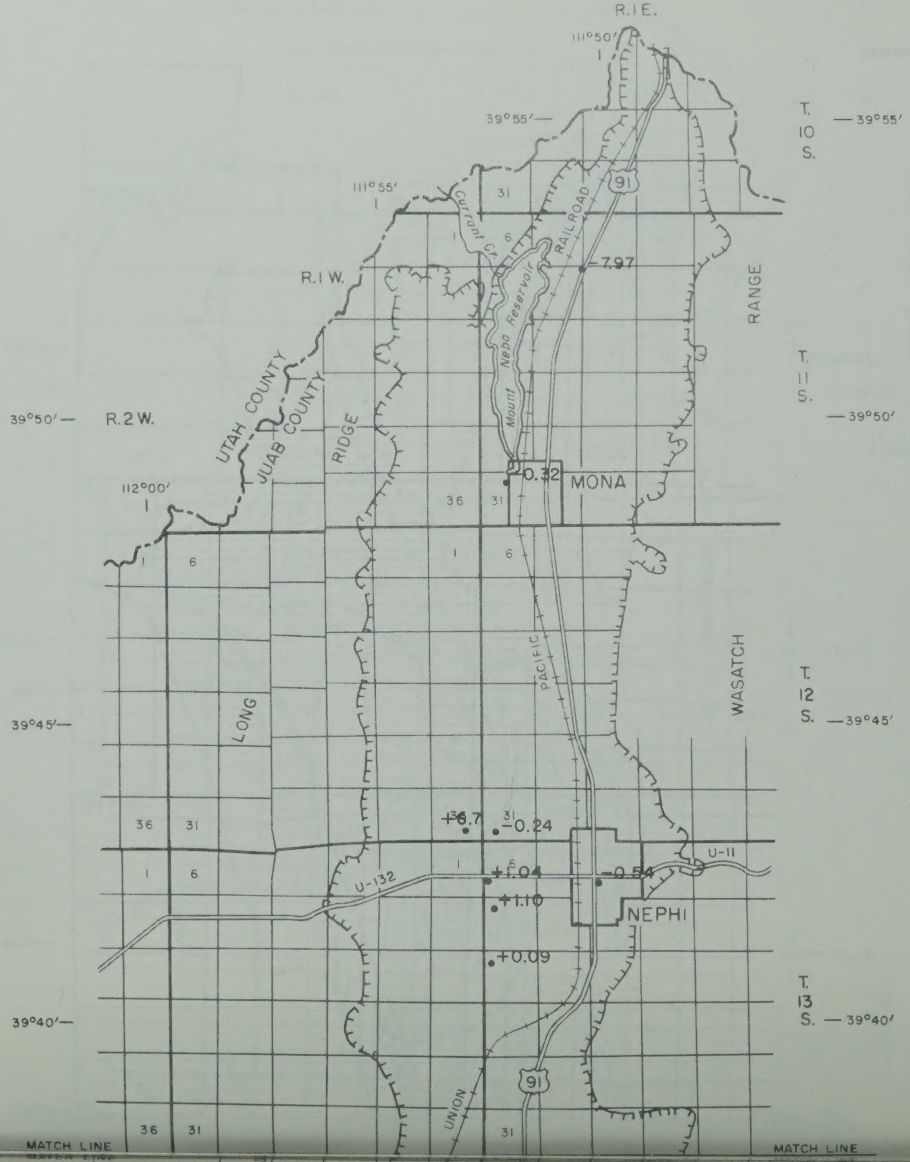


Base derived from general highway map

by R. G. Butler

Figure 24.—Map of Juab Valley showing change of water levels from March 1967 to March 1968.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T. 10 S.
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RAILROAD
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R.1 W.
Nebo Reservoir
Mount
RANGE
T. 11 S.
39°50′
R.2 W.
UTAH COUNTY
JUAB COUNTY
RIDGE
39°50′
-0.32
MONA
112°00′
36
31
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1
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PACIFIC
WASATCH
T. 12 S.
39°45′
LONG
39°45′
36
31
+6.7
36
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-0.24
U-11
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U-132
+1.04
-0.54
+1.10
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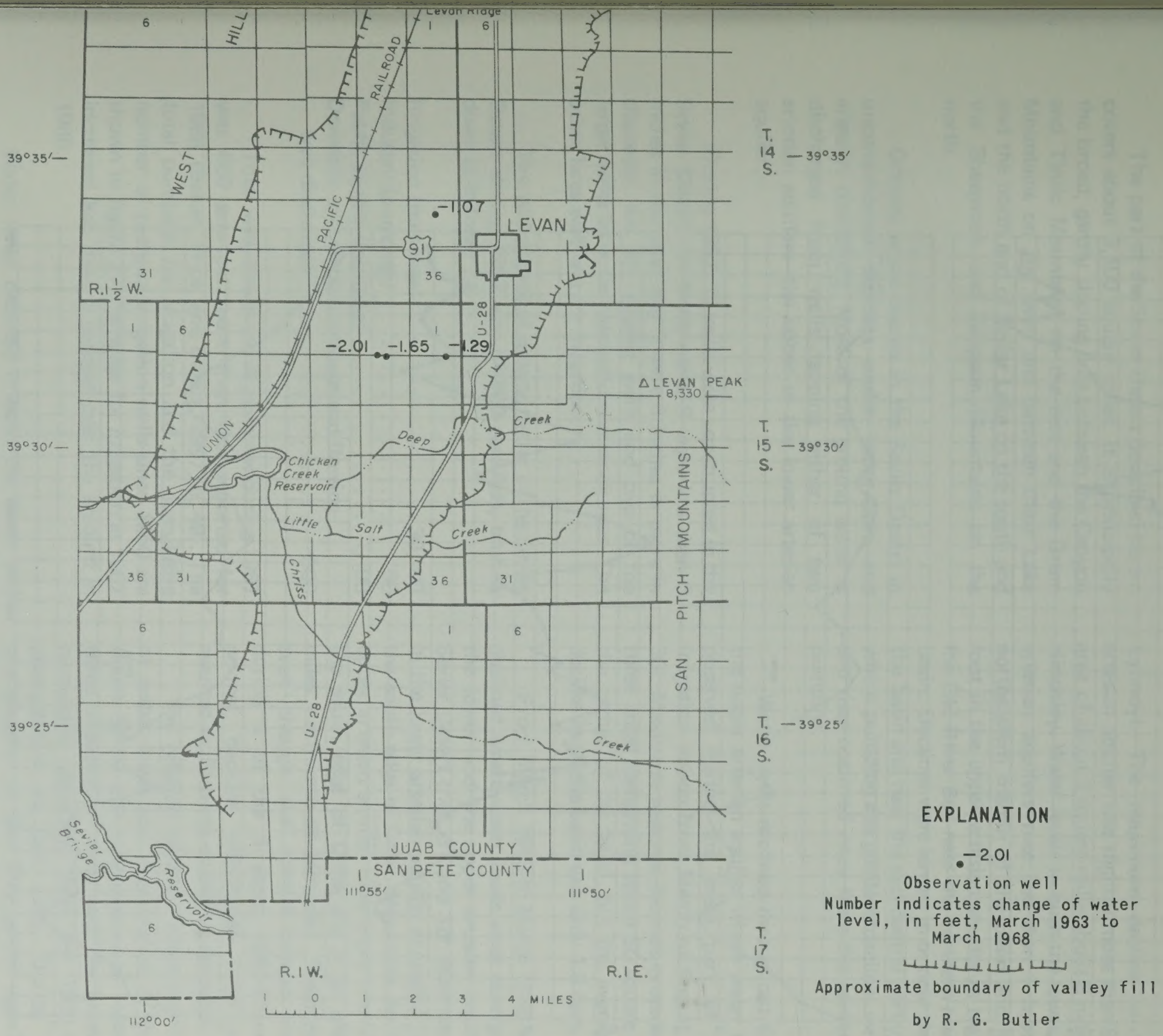


Base derived from general highway map

Figure 25.—Map of Juab Valley showing change of water levels from March 1963 to March 1968.

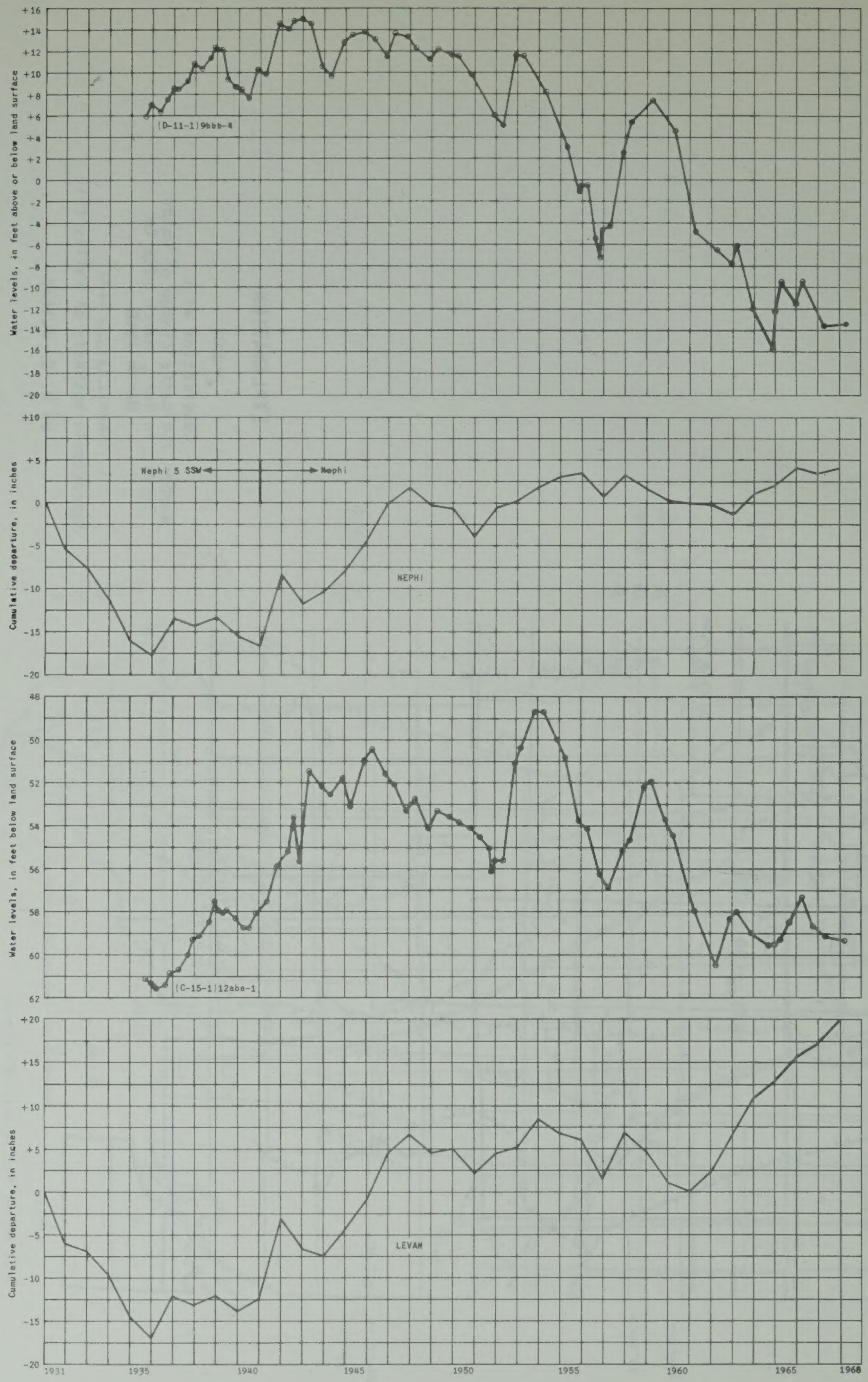


Figure 26.—Relation of water levels in wells (D-11-1)9bbb-4 and (C-15-1)12aba-1 to cumulative departure from the 1931-60 normal annual precipitation at Nephi and Levan.

SEVIER DESERT

by R. W. Mower

The part of the Sevier Desert described herein covers about 3,100 square miles. It is principally the broad, gently sloping area between the Canyon and Tintic Mountains on the east and the Drum Mountains on the west, and between Clear Lake and the north end of Sevier Lake on the south and the Sheeprock and Simpson Mountains on the north.

Ground water occurs in the Sevier Desert in unconsolidated deposits under water-table and artesian conditions. Most of the ground water is discharged from wells tapping either of two artesian aquifers—the upper or the lower artesian aquifer.

During 1967, 12 wells were constructed in the Sevier Desert. Of these wells, 9 were less than 6 inches in diameter and 3 were 6 inches or more in diameter. All the smaller wells and two of the larger wells were for domestic and stock uses. The other large well was for irrigation.

The withdrawal of ground water in the Sevier Desert during 1967 was 31,900 acre-feet, broken down as follows:

Irrigation (pumpage)	30,100
Industry (pumpage)	100
Public supply (pumpage)	1,100
Domestic and stock (pumpage and flowing-well discharge)	600

Total withdrawal for all purposes during 1967 was 600 acre-feet more than that reported for 1966 (Baker, Price, and others, 1967, p. 49). The total pumpage for irrigation and the cumulative number of pumped irrigation wells since 1950 are shown in figure 27. Pumpage for irrigation in 1967 increased less than 1 percent over the amount in 1966.

Water levels declined in both the lower and the upper artesian aquifers from March 1967 to March 1968 in most parts of the Sevier Desert (figs. 28 and 29). The maximum decline in the lower artesian aquifer was slightly more than 4 feet in an area of 50 square miles between Delta and Lynndyl. The maximum decline in the upper artesian aquifer was slightly more than 3 feet in an area of about 2 square miles about 8 miles north of Hinckley. Water levels in both the lower and upper artesian aquifers rose less than 1 foot near the northeastern margin of the basin and less than 1 foot in the upper artesian aquifer in two places in the Old River Bed near the northern margin of the basin. Declines were largest in or near the center of the basin and near the east-central part of the basin where pumping was greatest; declines were smallest and rises occurred away from the centers of heavy pumping.

Water levels declined throughout the parts of the upper artesian aquifer where water levels were observed during the main part of the 1967 irrigation season from March to August 1967 (fig. 30). Maximum seasonal declines exceeded 5 feet in three areas comprising about 30 square miles near the center of the basin, but the average seasonal decline in all the basin was only 1.8 feet.

From March 1963 to March 1968 water levels declined where water levels were observed in both the lower and the upper artesian aquifers in the Sevier Desert (figs. 31 and 32). Maximum declines in the lower artesian aquifer exceeded 15 feet near the south edge of Delta. Maximum declines in the upper artesian aquifer were more than 7 feet near the south edge of Delta and in an area about 5 miles northwest of Hinckley. Declines occurred even though the normal annual precipitation during 4 of the 5 years, 1963-67, was above normal, because withdrawals from wells have resulted in discharge exceeding recharge.

The relation between long-term fluctuations of water levels and precipitation is illustrated in figure 33 by the hydrographs of water levels in three observation wells and the graph showing cumulative departure from the 1931-60 normal precipitation at Oak City. During 1967 the precipitation at Oak City, which was 16 percent above normal, probably resulted in above-normal recharge. Despite such recharge, water levels in the observation wells continued on a downward trend that began in the early 1950's thus indicating that withdrawals from wells have caused total discharge to exceed recharge.

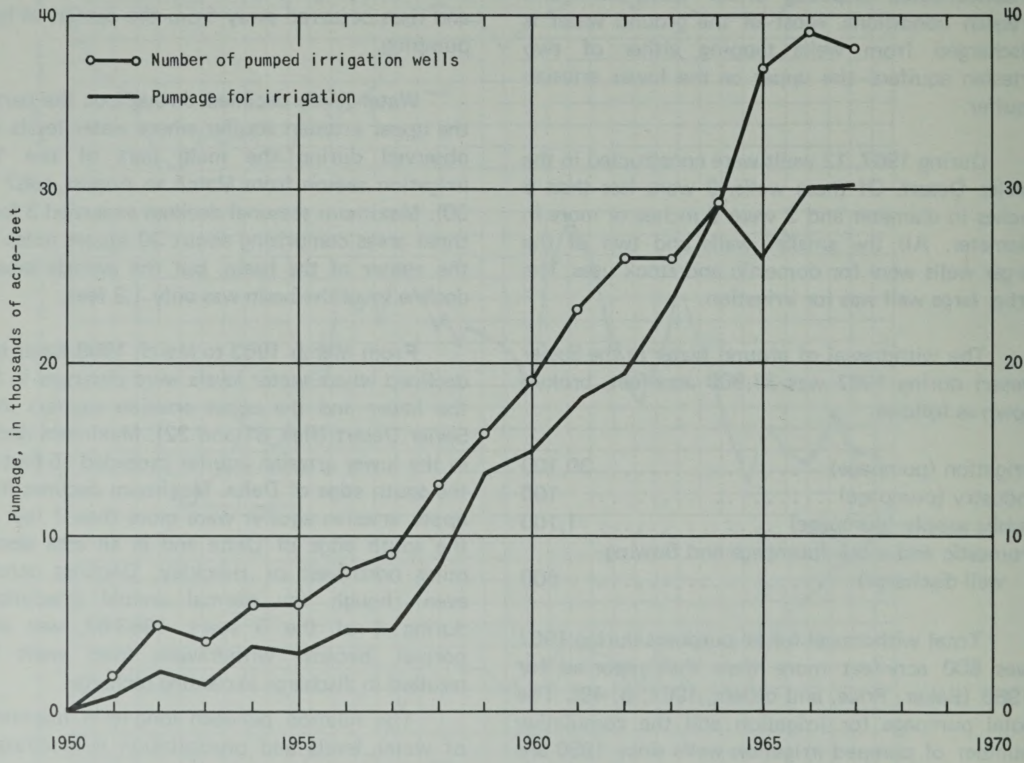


Figure 27.—Relation of number of pumped irrigation wells to pumpage for irrigation in the Sevier Desert, 1950-67.

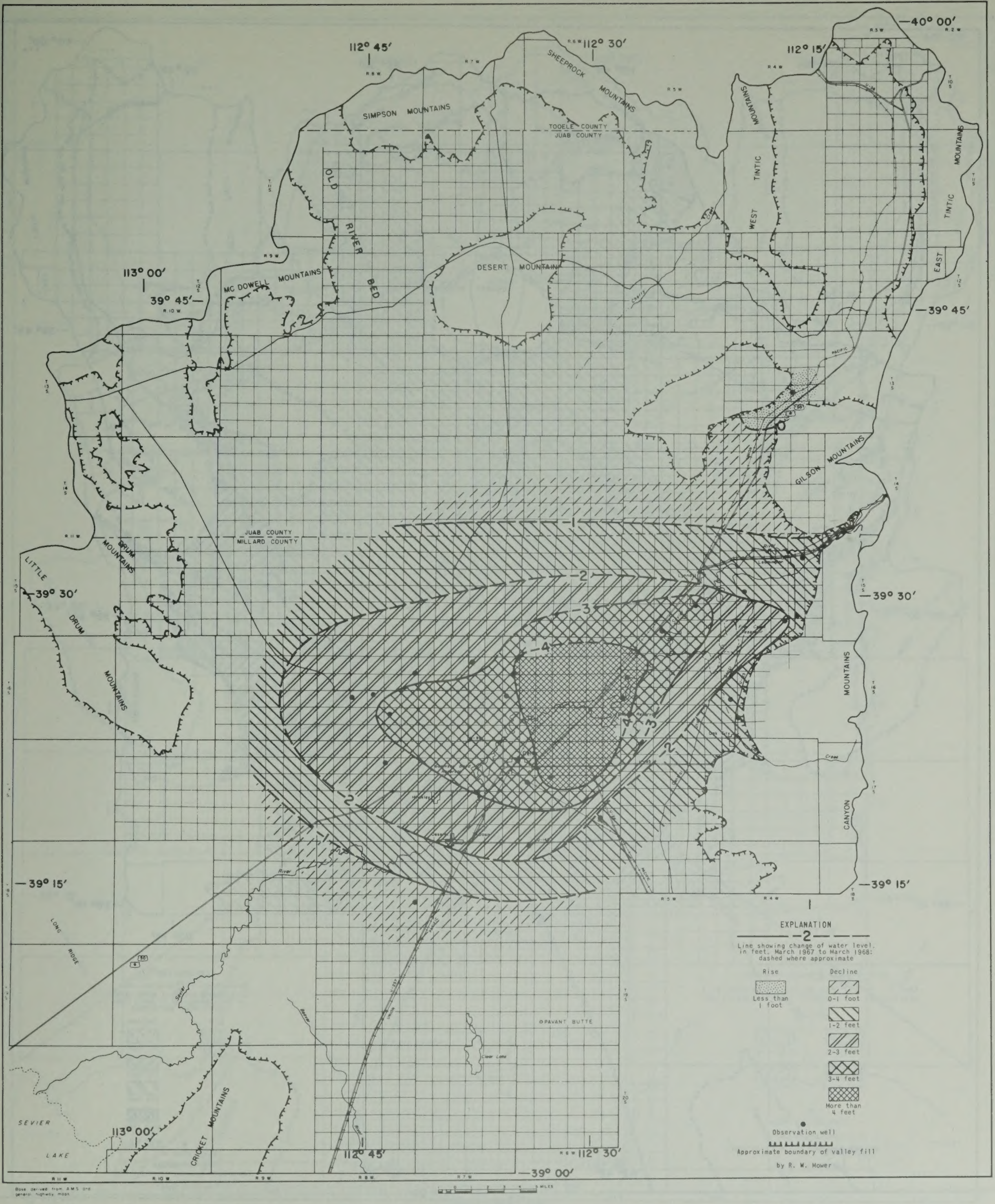
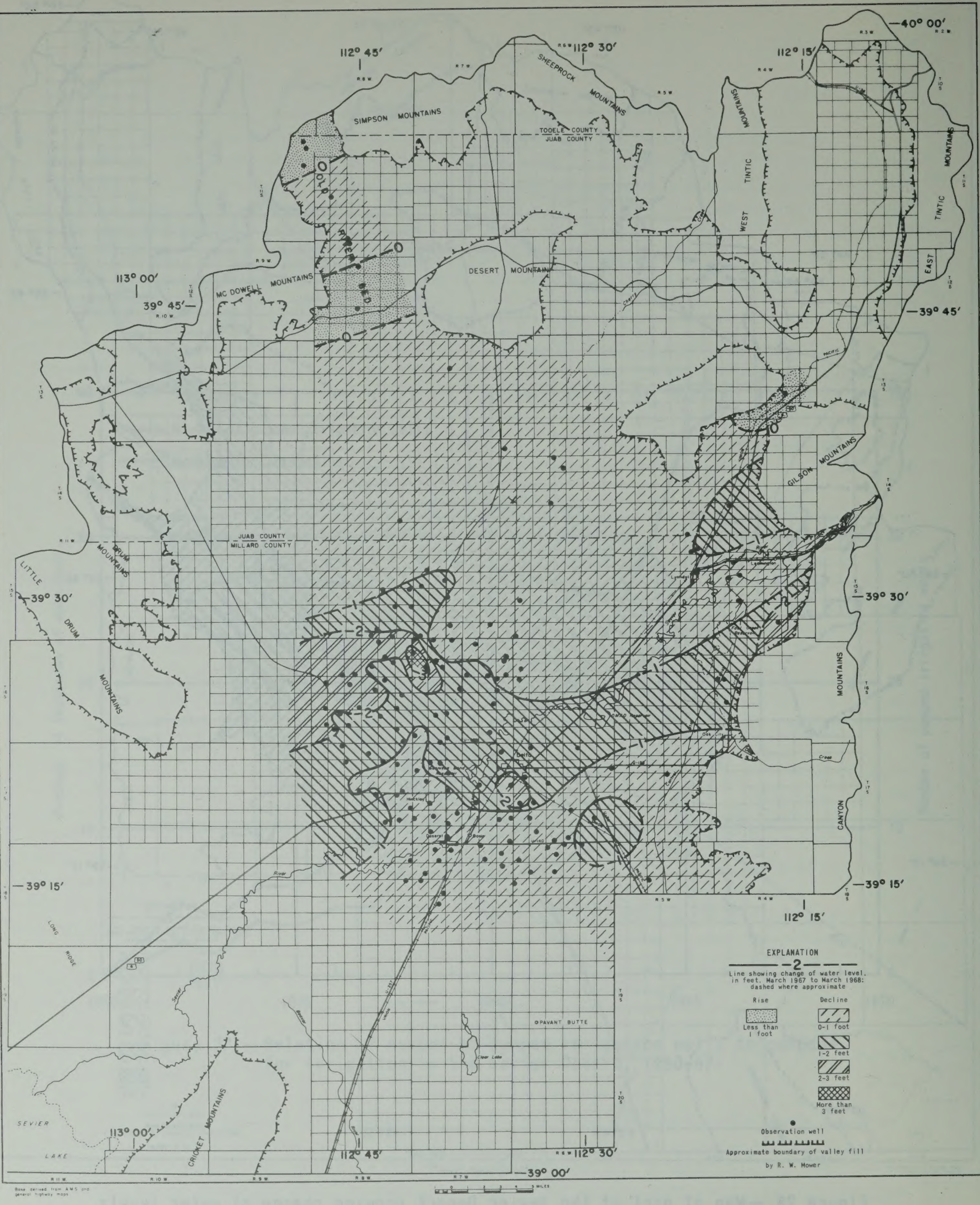
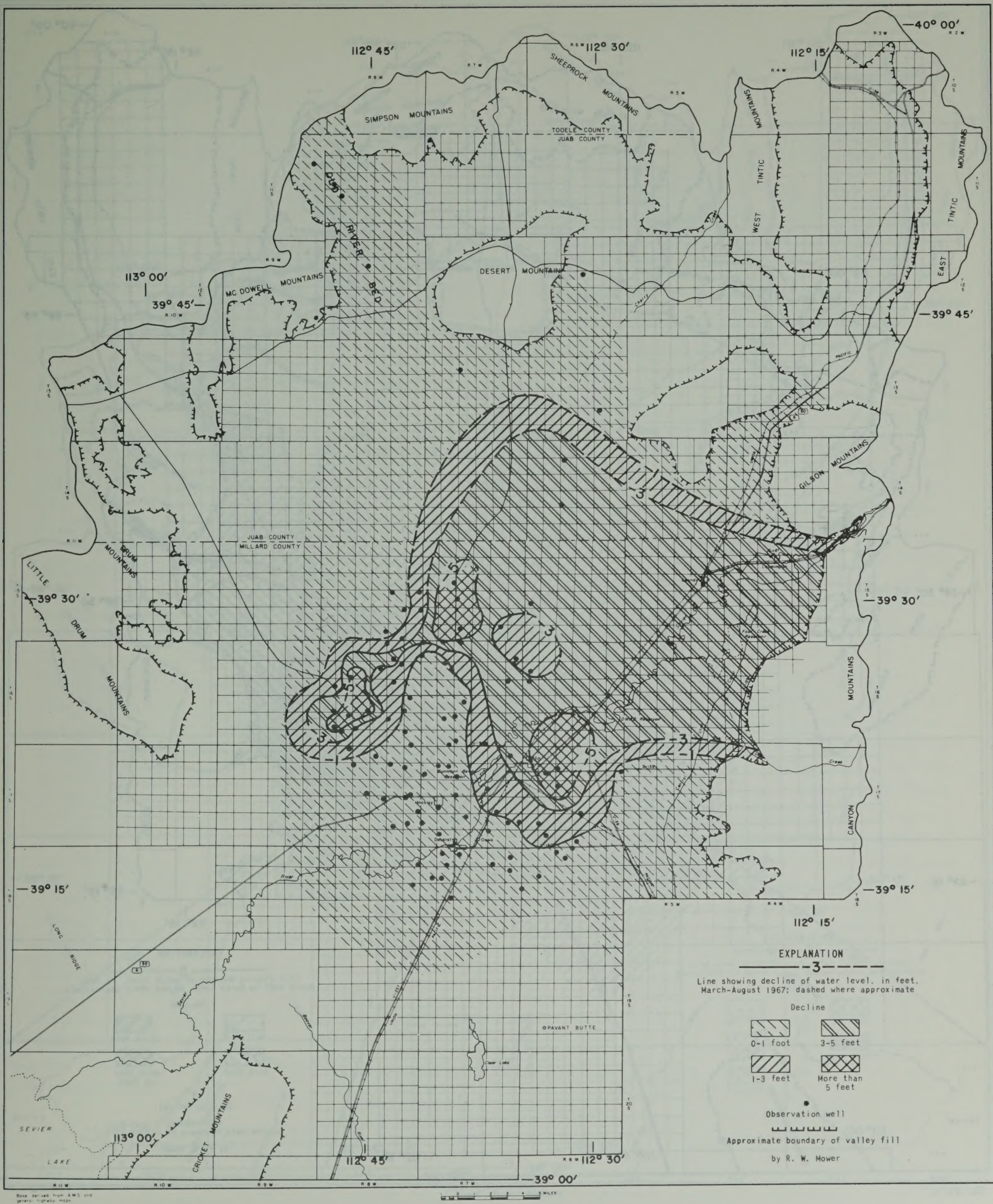


Figure 28.—Map of part of the Sevier Desert showing change of water levels in the lower artesian aquifer from March 1967 to March 1968.



Base derived from AMS and general highway maps

Figure 29.—Map of part of the Sevier Desert showing change of water levels in the upper artesian aquifer from March 1967 to March 1968.



Base derived from A.M.S. and general highway maps

Figure 30.—Map of part of the Sevier Desert showing change of water levels in the upper artesian aquifer from March to August 1967.

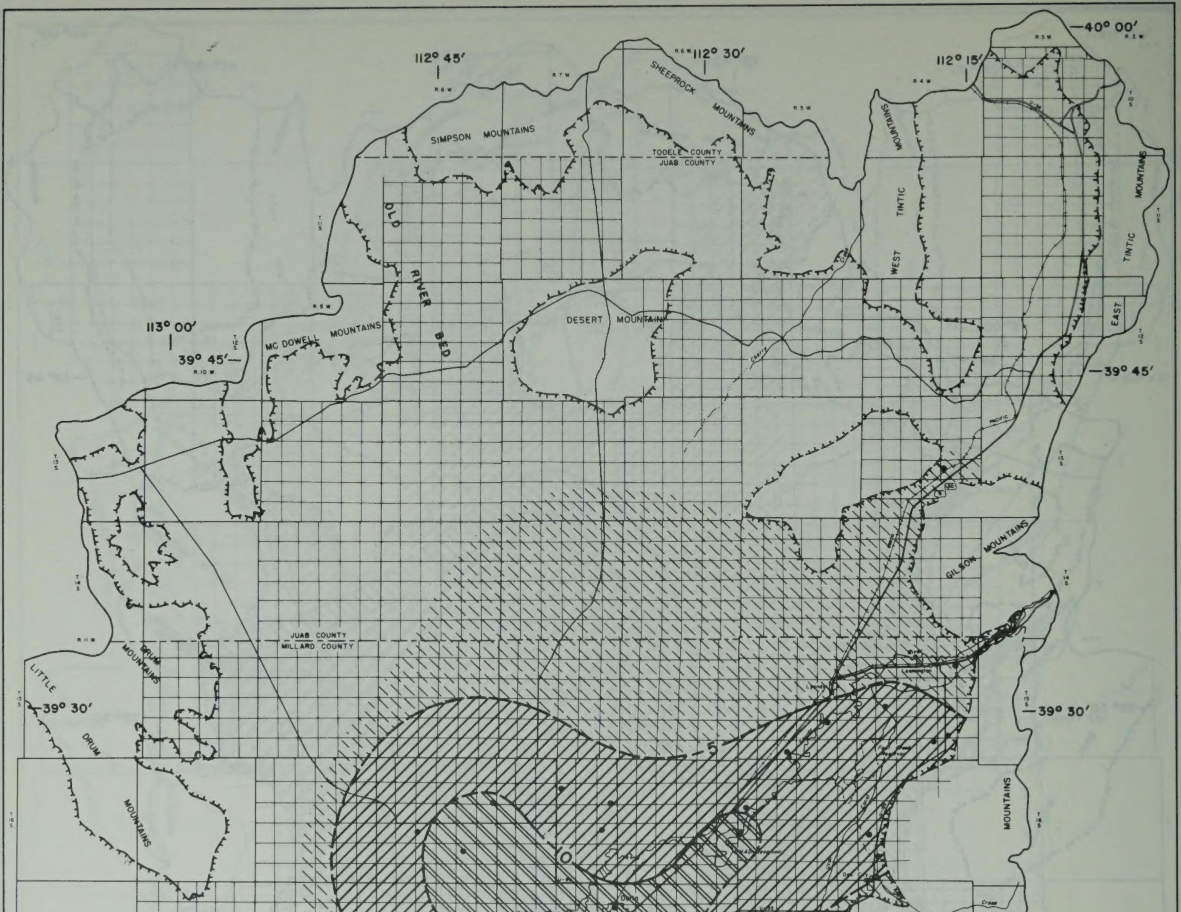


Figure 31.—Map of part of the Sevier Desert showing change of water levels in the lower artesian aquifer from March 1963 to March 1968.

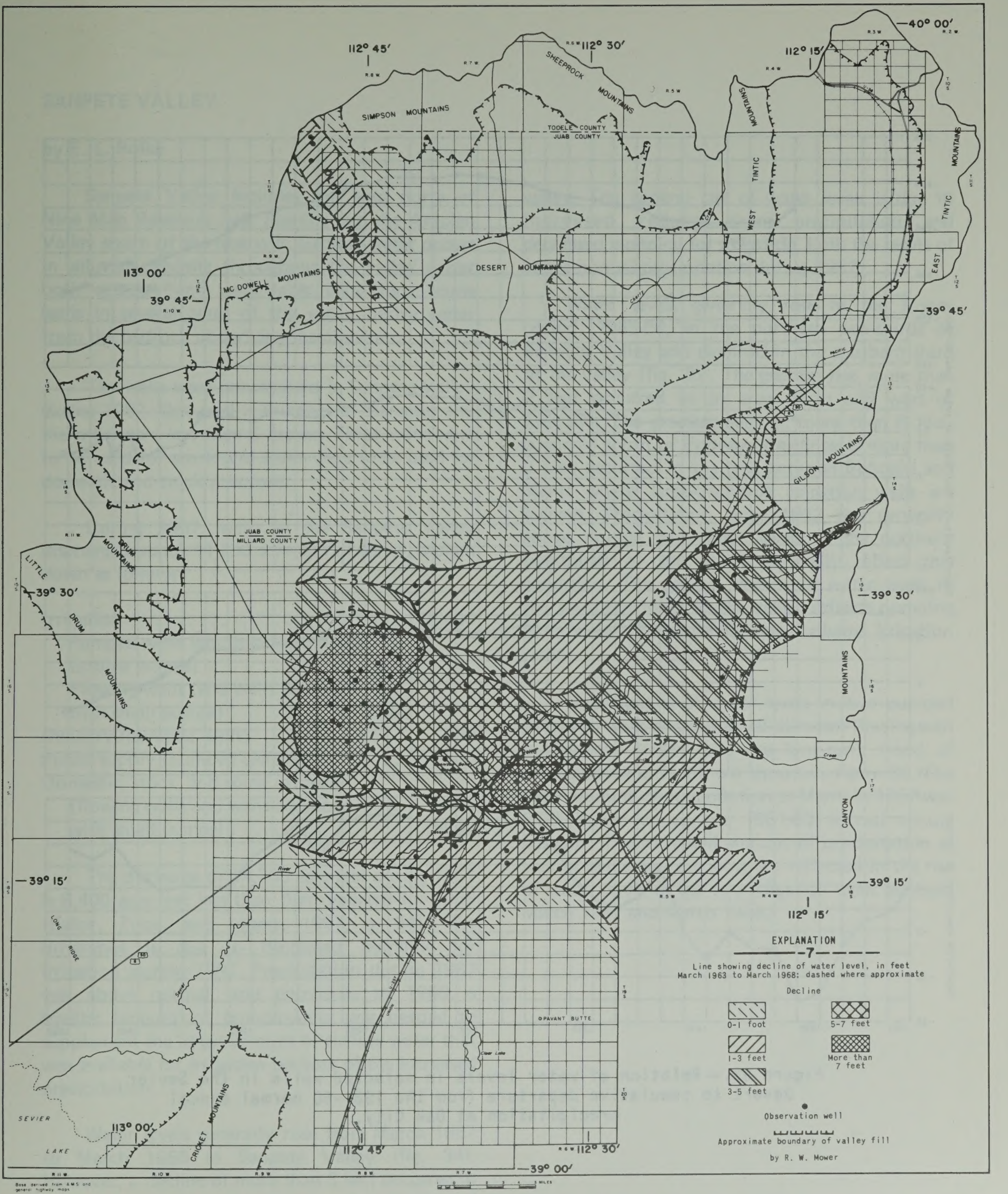


Figure 32.—Map of part of the Sevier Desert showing change of water levels in the upper artesian aquifer from March 1963 to March 1968.

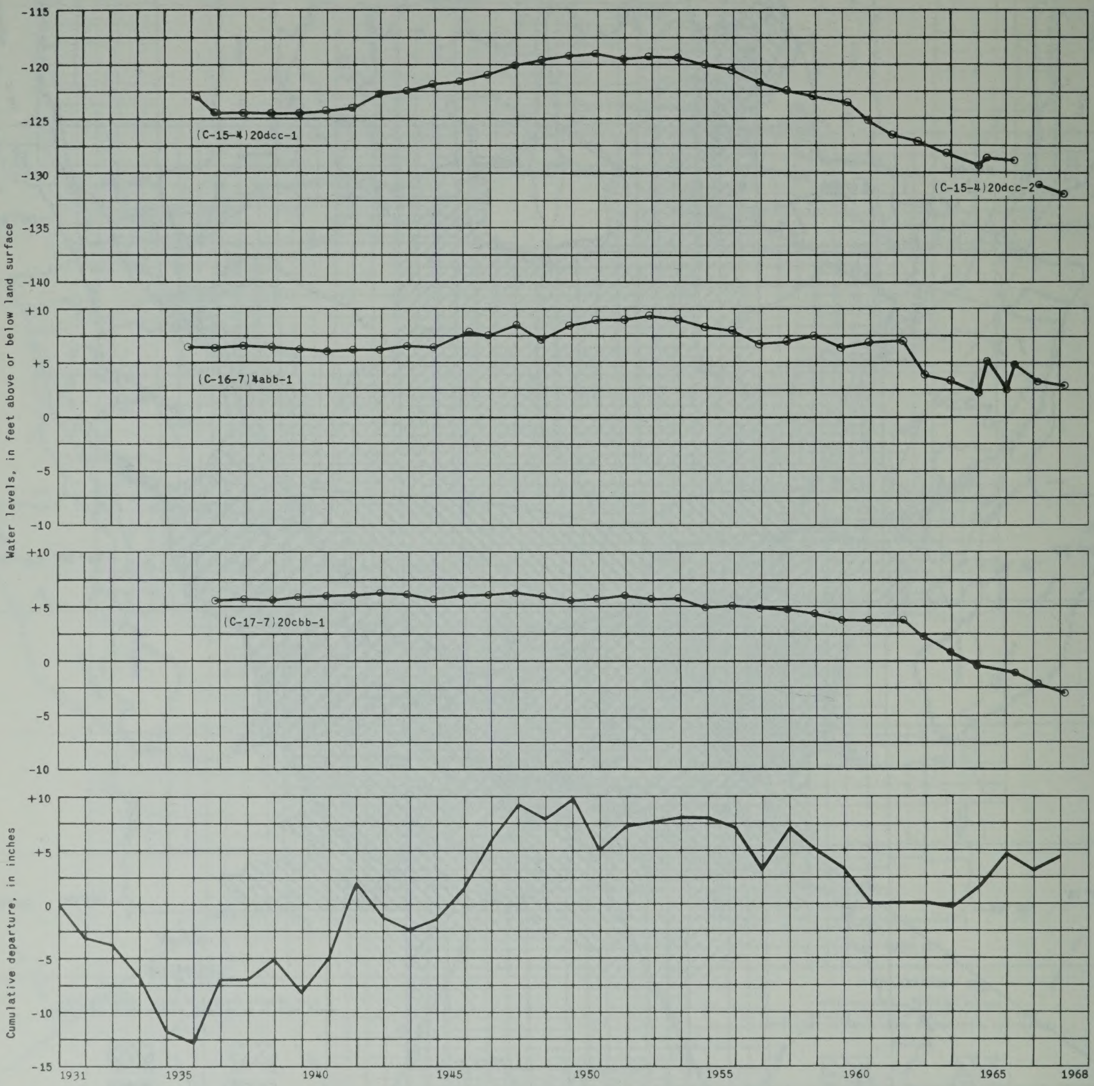


Figure 33.—Relation of water levels in selected wells in the Sevier Desert to cumulative departure from the 1931-60 normal annual precipitation at Oak City.

SANPETE VALLEY

by E. L. Bolke

Sanpete Valley includes the area north of Nine Mile Reservoir near Sterling and the Arapien Valley south of the reservoir. Ground water occurs in alluvial deposits throughout the valley under both artesian and water-table conditions; some wells in several areas of the valley derive water from the bedrock underlying the alluvium.

Ten wells were constructed in Sanpete Valley during 1967. One well is 6 inches in diameter and the others are less than 6 inches. Three wells were to be used for stock and seven were to be used for domestic and stock purposes.

During 1967, wells in the Sanpete Valley discharged about 14,700 acre-feet of water, broken down as follows:

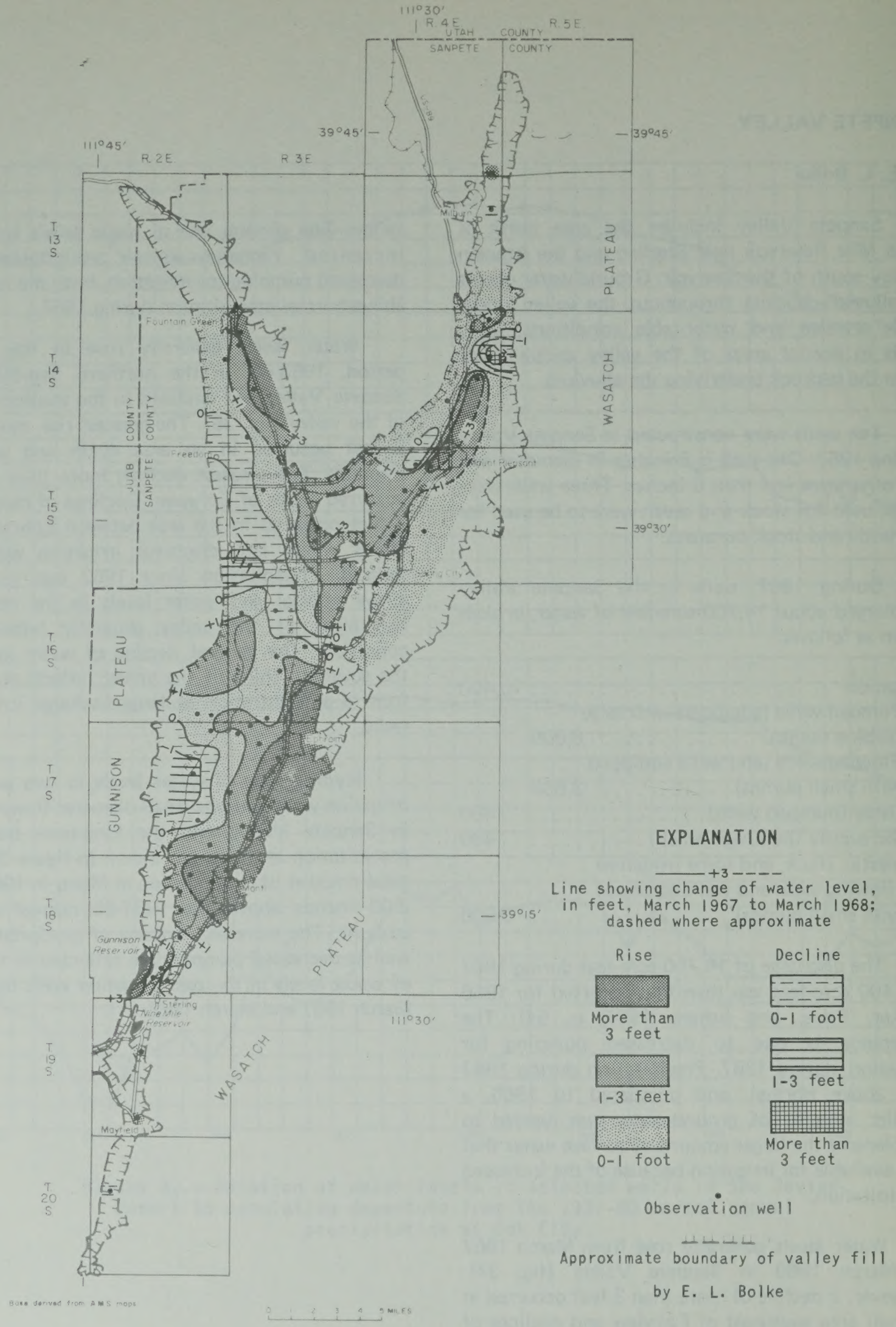
Irrigation		10,400
Pumped wells (equipped with large turbine pumps)	6,800	
Flowing wells (and wells equipped with small pumps)	3,600	
Industry (pumped wells)		400
Public supply (pumped wells)		400
Domestic, stock, and some irrigation (flowing wells and wells equipped with small pumps)		3,500

The discharge of 14,700 acre-feet during 1967 is 6,400 acre-feet less than that reported for 1966 (Baker, Price, and others, 1967, p. 54). The difference is due to decreased pumping for irrigation during 1967. Precipitation during 1967 was above normal, and compared to 1966, a smaller amount of ground-water was needed to supplement the larger amount of surface water that was available for irrigation because of the increased precipitation.

Water levels generally rose from March 1967 to March 1968 in Sanpete Valley (fig. 34). However, a decline of more than 3 feet occurred in a small area southeast of Fairview and declines of 1-3 feet occurred in small areas near Wales and northwest of Manti along the western edge of the valley. The general rise of water levels is due to increased recharge from precipitation and decreased pumping for irrigation, both the result of above-normal precipitation during 1967.

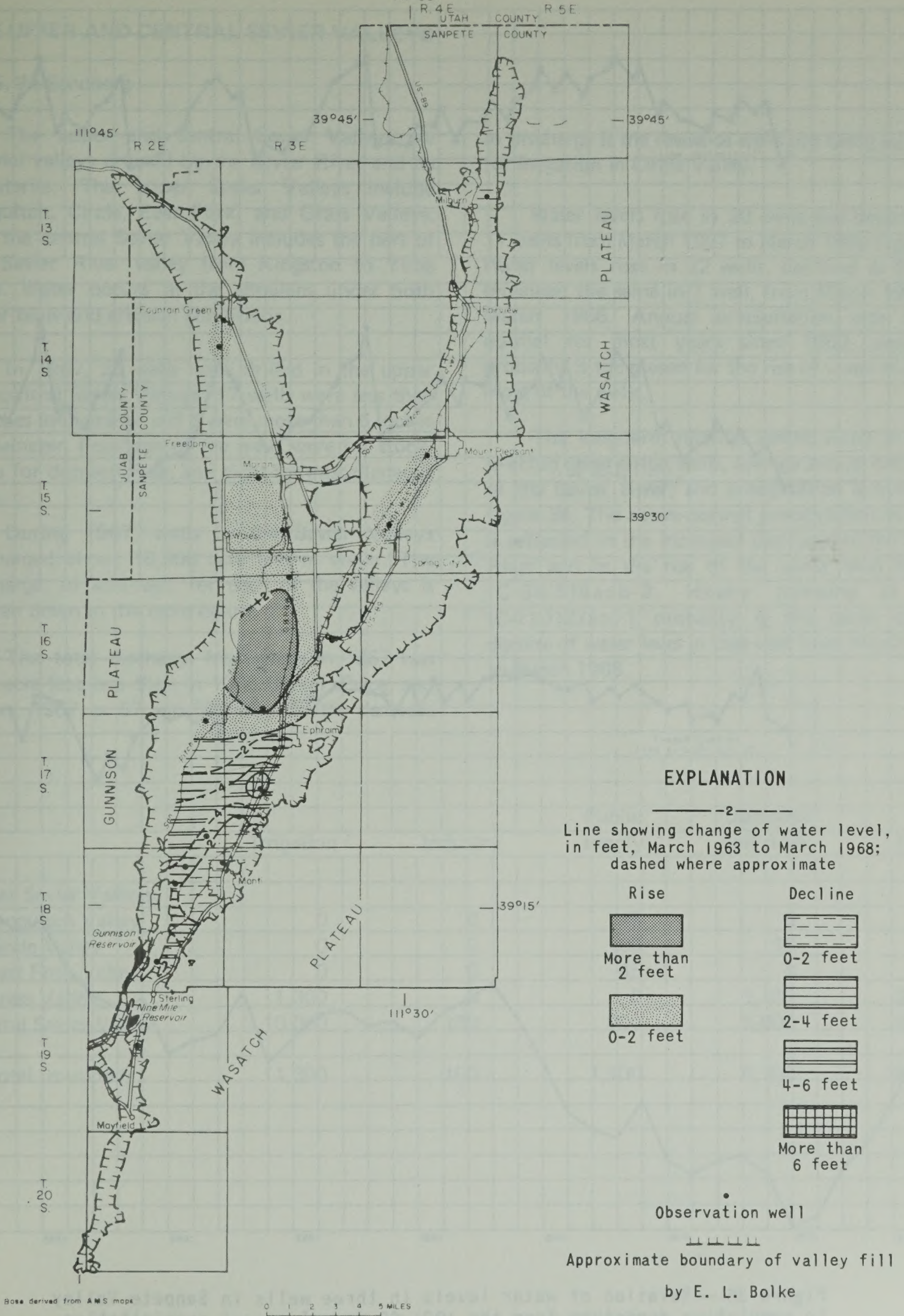
Water levels generally rose in the 5-year period, 1963-68, in the northern two-thirds of Sanpete Valley and declined in the southern third of the valley (fig. 35). The greatest rise, more than 2 feet occurred in an area north and west of Ephraim. The greatest decline, more than 6 feet, occurred south of Ephraim. Declines of more than 2 feet occurred in the area between Ephraim and Manti where large-discharge irrigation wells are located. Precipitation since 1962 was generally above normal and water levels in the northern two-thirds of the valley generally reflect this condition. The general decline of water levels in the southern third of the valley reflects pumping from a concentration of large-discharge irrigation wells.

Hydrographs of water levels in two pumped irrigation wells and one small-diameter flowing well in Sanpete Valley and the long-term trend of precipitation at Manti are shown in figure 36. The total amount of precipitation at Manti in 1967 was 2.00 inches above the 1931-60 normal annual amount. The increased amount of precipitation as well as decreased pumping are reflected in the rise of water levels in the two irrigation wells between March 1967 and March 1968.



by E. L. Bolke

Figure 34.—Map of Sanpete Valley showing change of water levels from March 1967 to March 1968.



by E. L. Bolke

Figure 35.—Map of Sanpete Valley showing change of water levels from March 1963 to March 1968.

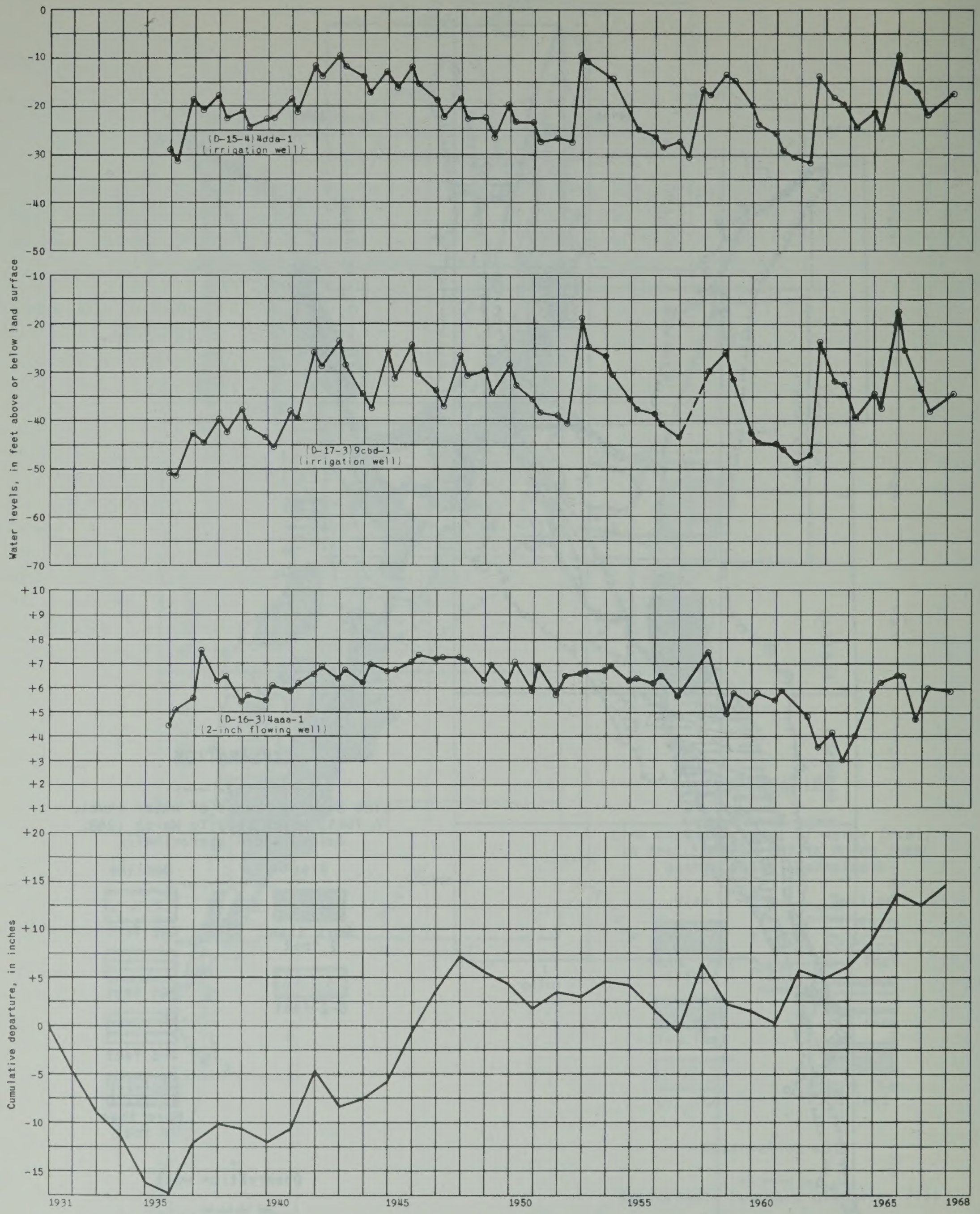


Figure 36.—Relation of water levels in three wells in Sanpete Valley to cumulative departure from the 1931-60 normal annual precipitation at Manti.

THE UPPER AND CENTRAL SEVIER VALLEYS

by G. W. Sandberg

The upper and central Sevier Valleys are alluvial valleys drained by the Sevier River and its tributaries. The upper Sevier Valleys include Panguitch, Circle, East Fork, and Grass Valleys; and the central Sevier Valley includes the part of the Sevier River valley from Kingston to Yuba Dam. Water occurs in the alluvium under both water-table and artesian conditions.

In 1967, 25 wells were drilled in the upper and central Sevier Valleys; 17 wells were less than 6 inches in diameter and 8 were more than 6 inches in diameter. Fourteen of the wells were for stock, three for domestic use, and eight for miscellaneous uses.

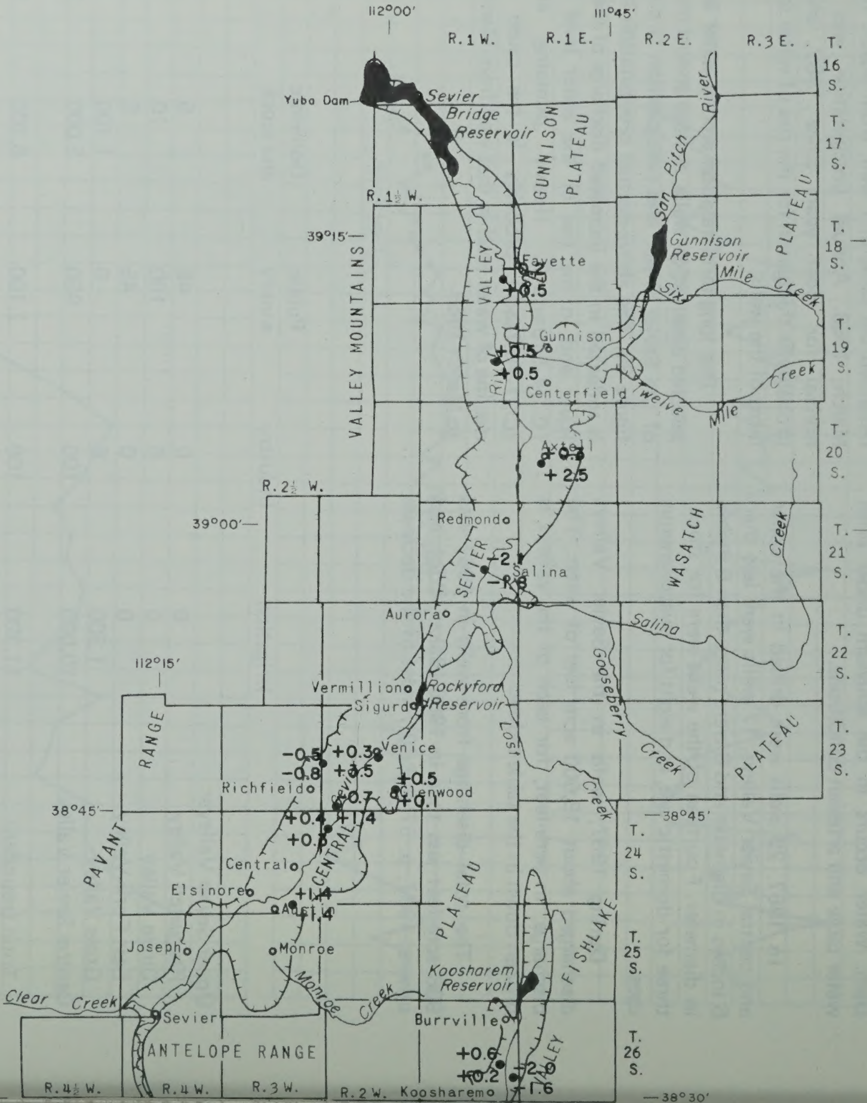
During 1967, wells in the Sevier Valleys discharged about 18,600 acre feet of water. The discharge, in acre-feet, for each of the valleys is broken down in the table below.

The total discharge from wells in 1967 was 900 acre-feet less than in 1966 (Baker, Price, and others, 1967, p. 57 and 60). Most of the decrease in discharge is the result of wells not being pumped for irrigation in Circle Valley.

Water levels rose in 20 wells and declined in 11 wells from March 1967 to March 1968 (fig. 37). Water levels rose in 22 wells, declined in 8, and remained the same in 1 well, from March 1963 to March 1968. Annual precipitation was above normal for most years since 1962, and this probably is the reason for the rise of water levels in most of the wells.

The long-term relation among water levels in selected observation wells, average annual discharge of the Sevier River, and precipitation is shown in figure 38. The above-normal precipitation in 1967 is reflected in the increased discharge of the Sevier River and in the rise of the water level in well (C-34-5)8adb-2. Heavy pumping at well (C-21-1)27aad-1 probably is the cause of the decline of water level in that well from March 1967 to March 1968.

	Irrigation	Industry	Public supply	Domestic and stock	Total
Upper Sevier Valleys:					
Panguitch Valley	0	0	45	5	50
Circle Valley	0	0	100	10	110
East Fork Valley	0	0	45	5	50
Grass Valley	1,300	0	0	1,100	2,400
Central Sevier Valley	10,000	100	900	5,000	16,000
Total (rounded)	11,300	100	1,100	6,100	18,600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38°45′
38°30′
Yuba Dam
Sevier Bridge Reservoir
GUNNISON PLATEAU
San Pitch River
PLATEAU
Gunnison Reservoir
Six Mile Creek
VALLEY MOUNTAINS
VALLEY
Fayette
-0.2
+0.5
Gunnison
+0.5
+0.5
River
Centerfield
Twelve Mile Creek
Axtell
+0.3
+2.5
Redmond
SEVIER
-2.1
Salina
-1.8
WASATCH
Creek
Aurora
Salina
Gooseberry Creek
Vermillion
Rockyford Reservoir
Sigurd
Lost Creek
RANGE
Venice
-0.5
+0.3
-0.8
+3.5
+0.5
Richfield
Glenwood
+0.7
+0.1
Sevier
+0.4
+1.4
+0.3
CENTRAL
PLATEAU
PAVANT
Central
Elsinore
+1.4
Austin
+1.4
PLATEAU
FISHLAKE
Joseph
Monroe
Monroe Creek
Koosharem Reservoir
Clear Creek
Sevier
Burrville
ANTELOPE RANGE
+0.6
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-2.0
+1.6
VALLEY
Koosharem

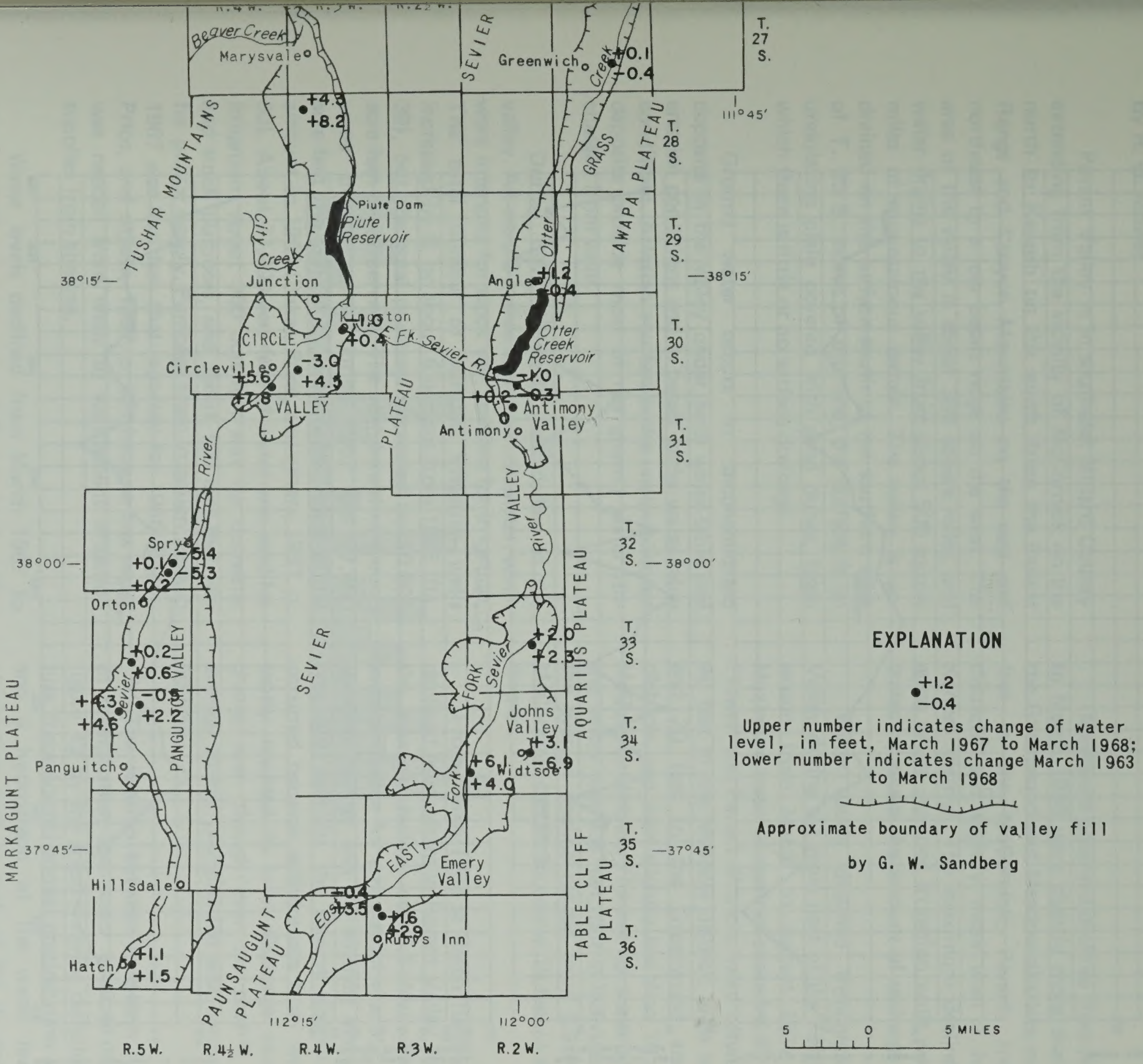


Figure 37.—Map of the upper and central Sevier Valleys showing change of water levels from March 1967 to March 1968 and from March 1963 to March 1968.

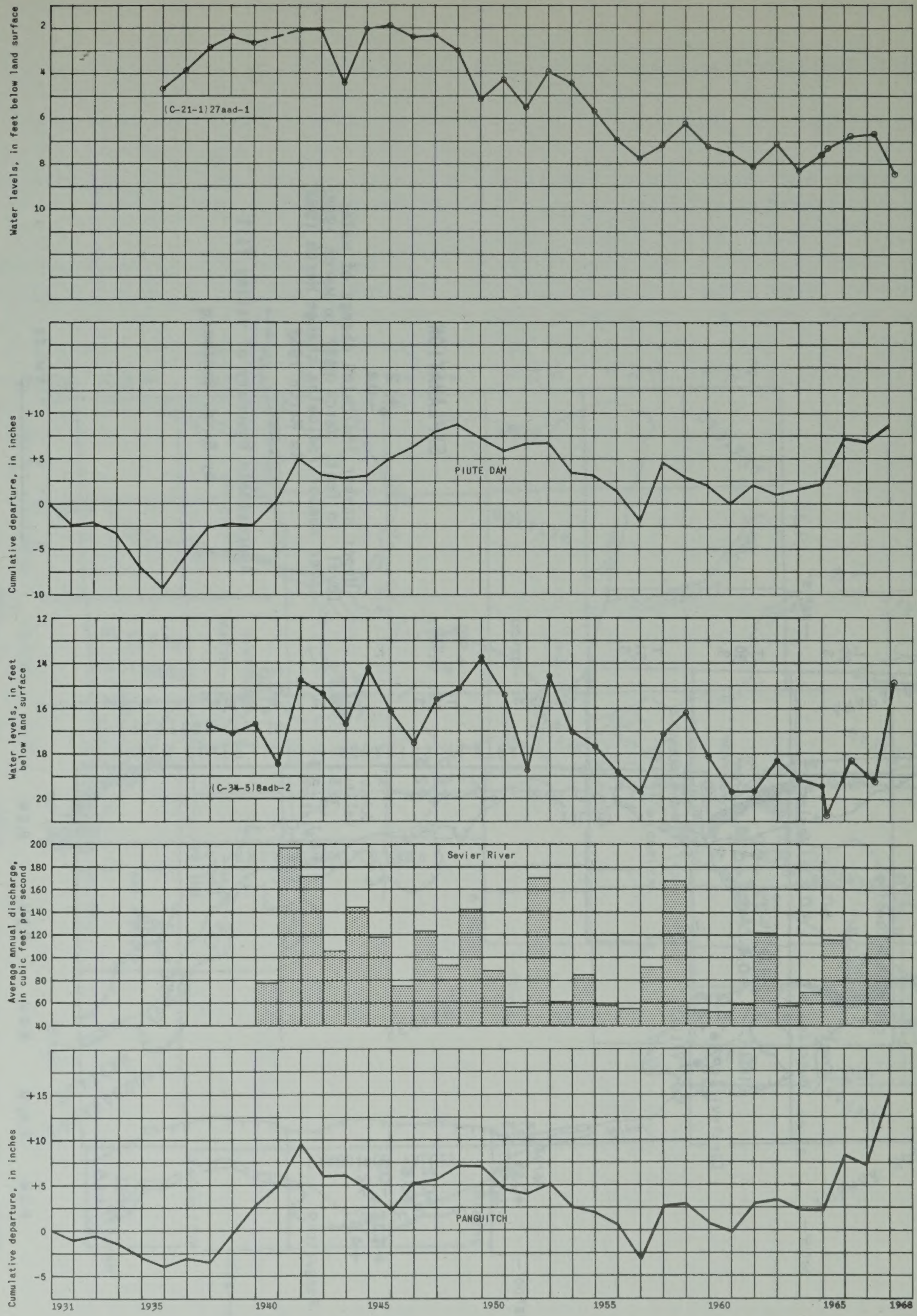


Figure 38.—Relation of water levels in selected observation wells and of average annual discharge of the Sevier River at Hatch to cumulative departure from the 1931-60 normal annual precipitation at Piute Dam and Panguitch.

PAVANT VALLEY

by R. W. Mower

Pavant Valley is in southeast Millard County extending from the vicinity of McCornick on the north to Kanosh on the south, from the Pavant Range and Canyon Mountains on the east and northeast to a low basalt ridge on the west. The area of the valley is about 300 square miles, and water drains to the valley from about 500 square miles of mountainous terrain. The valley is undrained on the surface south of the southern edge of T. 20 S.; north of this line, the surface is an undulating plain covered with sand dunes, from which there is little or no surface drainage.

Ground water occurs in unconsolidated deposits in the valley under both water-table and artesian conditions and in basalt under water-table conditions. Artesian aquifers in the unconsolidated deposits provide most of the ground water discharged from wells.

During 1967, 12 wells were drilled in the valley. All were 6 inches or more in diameter; seven were intended for stock use, and five for irrigation. The total number of pumped irrigation wells increased by 8, or about 6 percent from 1966 (fig. 39), but the total pumpage decreased by 10,800 acre-feet or 12 percent. The withdrawal of ground water in the valley during 1967 was 77,400 acre-feet (fig. 39), or 11,100 acre-feet less than the amount in 1966 (Baker, Price, and others, 1967, p. 63). About 77,000 acre-feet of water was used for irrigation, about 300 acre-feet was for domestic and stock purposes, and about 100 acre-feet was for public supply. Pumpage from irrigation wells in 1967 was less than that reported for 1966 (Baker, Price, and others, 1967, p. 63) because less water was needed from wells to supplement irrigation supplies from streams.

Water levels declined from March 1967 to March 1968 in most parts of Pavant Valley (fig. 40); the only rise was one of less than 1 foot in a small area in the southeastern part of the Kanosh district. The average net decline of water levels in the valley was 1.3 feet in contrast to an average decline of 2.4 feet observed from March 1966 to March 1967.

Maximum observed declines from March 1967 to March 1968 were slightly more than 4 feet in the Greenwood and Meadow districts, more than 2 feet in the McCornick, Pavant, and Flowell districts, and slightly more than 1 foot in the Kanosh district. The maximum declines were in areas where pumped irrigation wells were concentrated or where the amount of recharge was small.

Water levels declined throughout Pavant Valley during the main part of the 1967 irrigation season from March to August 1967 (fig. 41). Maximum seasonal declines exceeded 40 feet in the Flowell and Pavant districts, were between 30 and 40 feet in the Meadow district, were between 10 and 20 feet in the Greenwood and Kanosh districts, and were slightly less than 10 feet in the McCornick district. The average seasonal decline in the valley was 9.0 feet, but in individual districts the average decline ranged from 3.9 feet in the McCornick district to nearly 15 feet in the Flowell district.

From March 1963 to March 1968 water levels declined everywhere in Pavant Valley (fig. 42) and the average decline was 6.8 feet. The greatest average decline for any district was 9.2 feet in the Meadow district and the smallest average decline was 5.9 feet in the Pavant district. Declines occurred because withdrawals from wells consistently resulted in total discharge exceeding recharge even though over the past 5 years the average annual precipitation was normal to above normal.

The relation between long-term fluctuations of precipitation and water levels is illustrated in figure 43 by the graph showing cumulative departure from normal annual precipitation at Fillmore and a hydrograph of the water levels in an observation well in each of the six ground-water districts. Precipitation in 1967 at Fillmore was 4.37 inches above normal, or 31 percent above normal. Water levels during 1967 declined from 0.0 to 2.6 feet in five of the wells shown in figure 43 and continued the downward trend that began between 1947 and 1955. These changes indicate that withdrawal of water from wells resulted in discharge exceeding recharge in five of the six ground-water districts.

The concentration of dissolved solids in ground water ranges widely in Pavant Valley. The lowest concentrations are near the eastern margin of the valley, as at well (C-23-5)5acd-1 in the southeastern part of the Meadow district, where the concentration in 1966 was less than 500 mg/1 (milligrams per liter)[1]; the highest concentrations are near the western margin, as at well (C-23-6)8abd-1 near the northwestern edge of the center of pumping in the Kanosh district, where the concentration of dissolved solids is almost 4,700 mg/1 (fig. 44). The concentration of dissolved solids usually changes inversely with a large change in the rate of natural recharge. Natural recharge was slightly above normal during 1967, but the concentration of dissolved solids increased in 1967 in two wells sampled in the Kanosh district (fig. 44). The greatest increase in concentration was in well (C-23-6)8abd-1, which is in an area removed from the effect of natural recharge, and which discharges water that has been concentrated by recirculation from irrigated fields. The concentration of dissolved solids in water from this well increased 360 mg/1 from 1966 to 1967. During the 11-year period 1957-67, the concentration of dissolved solids in water from the well increased from 2,220 to 4,690 mg/1.

[1] Milligrams per liter, the units used here for reporting dissolved solids, can be considered equivalent to parts per million, the units used in previous reports of this series, provided concentrations are less than about 7,000 mg/1.

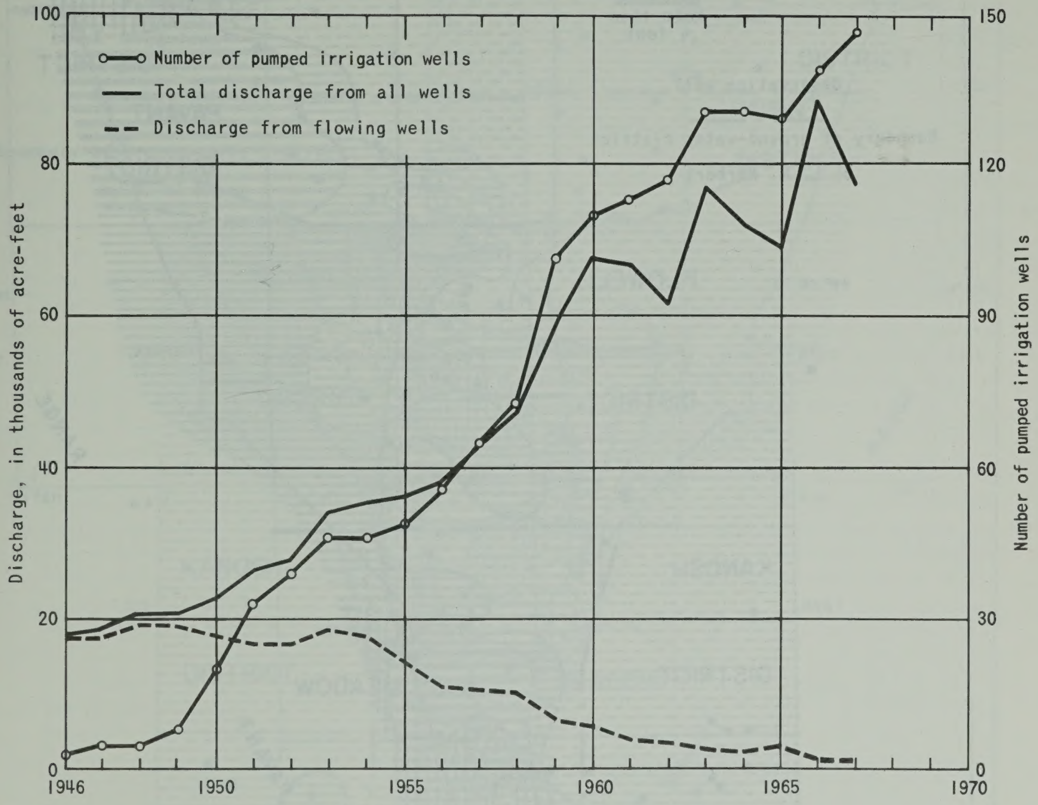


Figure 39.—Relation of number of pumped irrigation wells and total discharge from all wells to discharge from flowing wells in Pavant Valley, 1946-67.

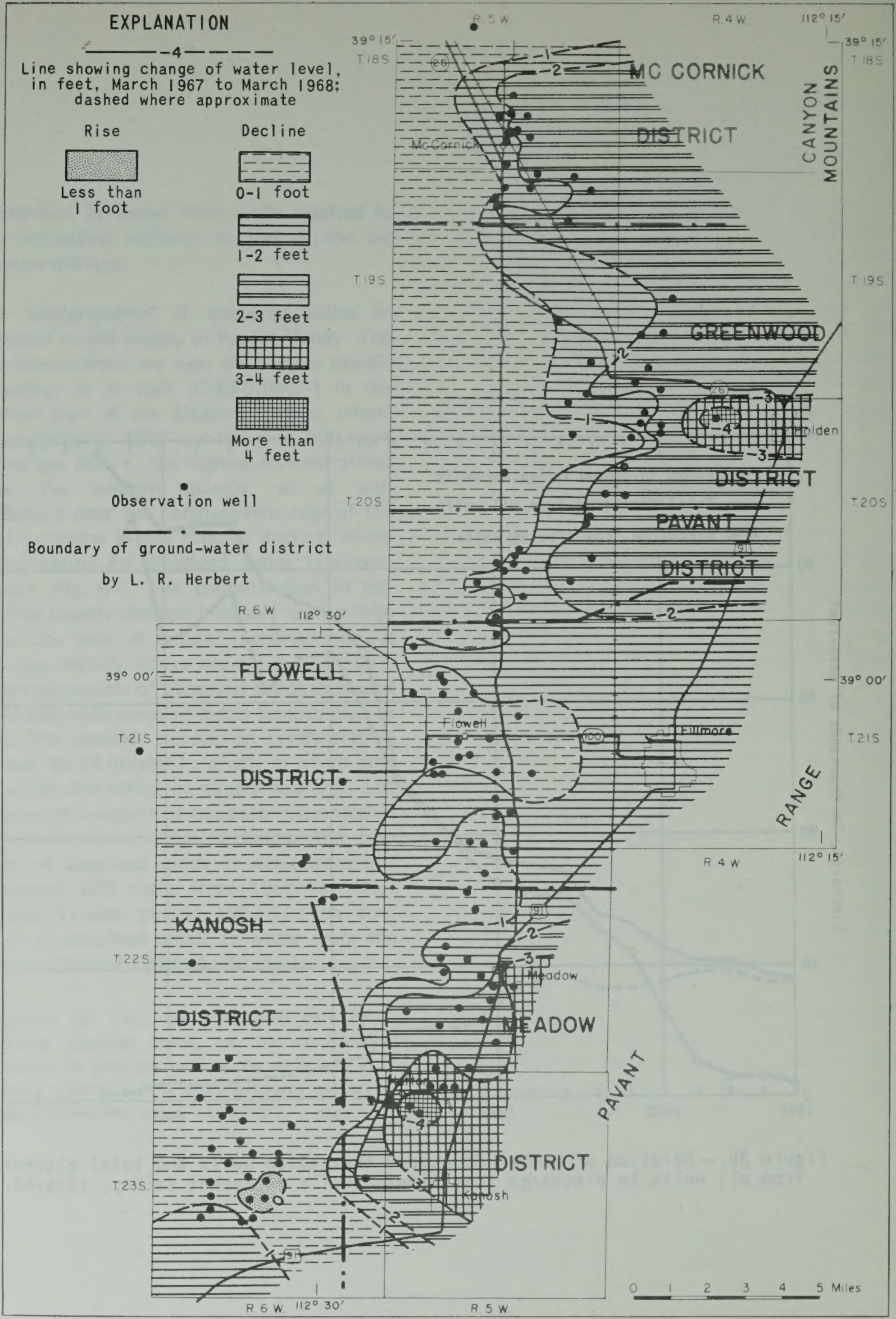


Figure 40.—Map of the Pavant Valley showing change of water levels from March 1967 to March 1968.

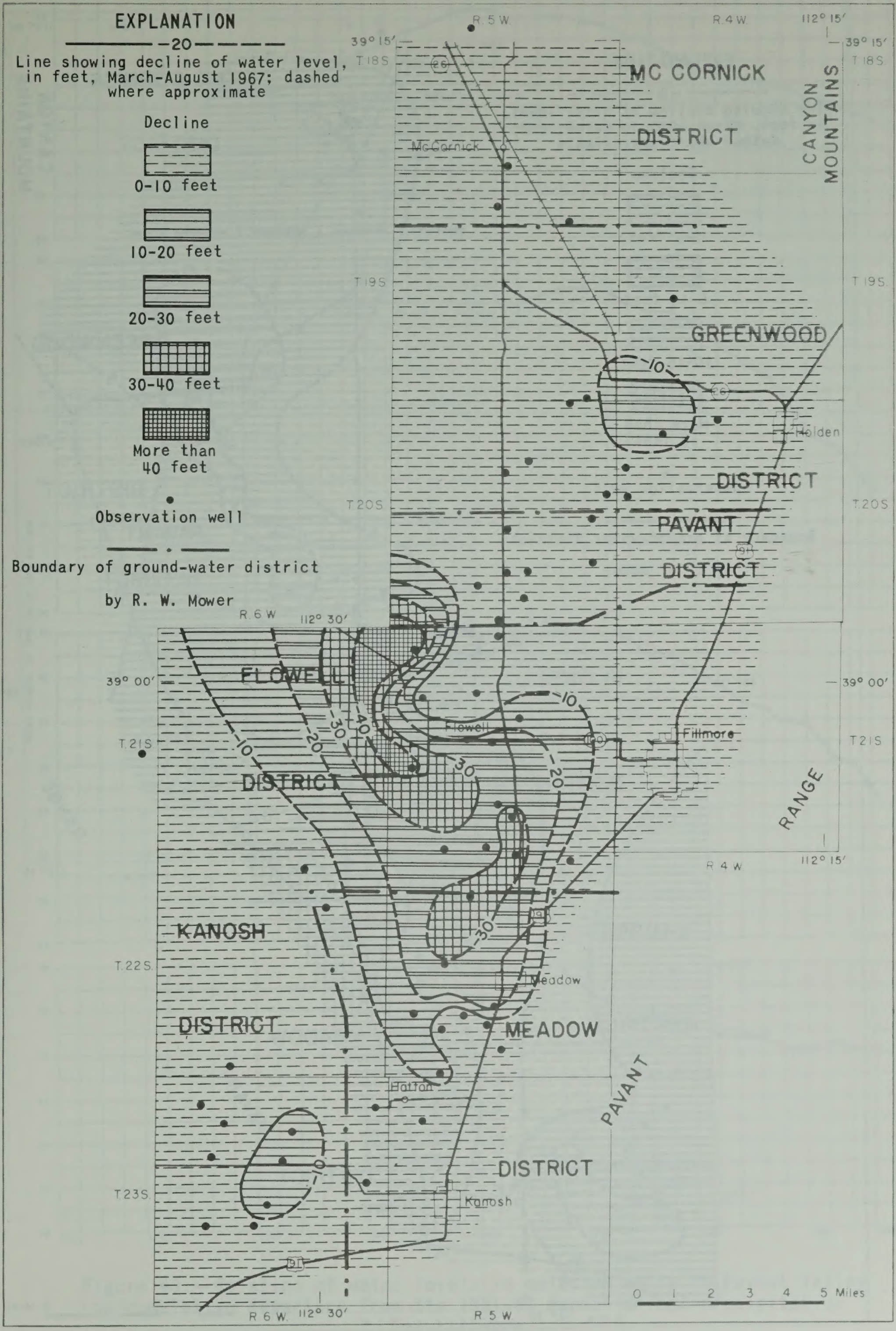


Figure 41.—Map of the Pavant Valley showing change of water levels from March to August 1967.

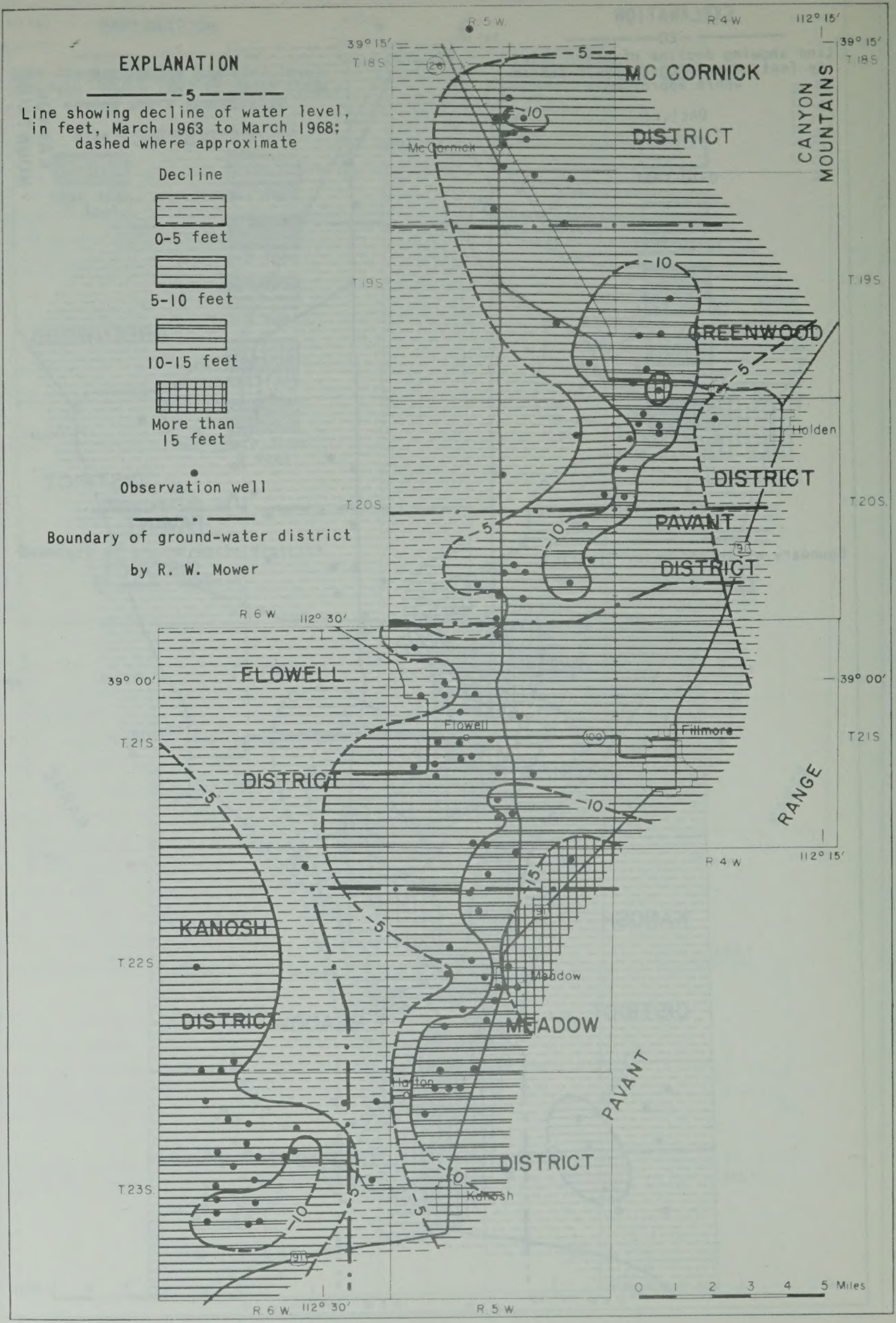


Figure 42.—Map of the Pavant Valley showing change of water levels from March 1963 to March 1968.

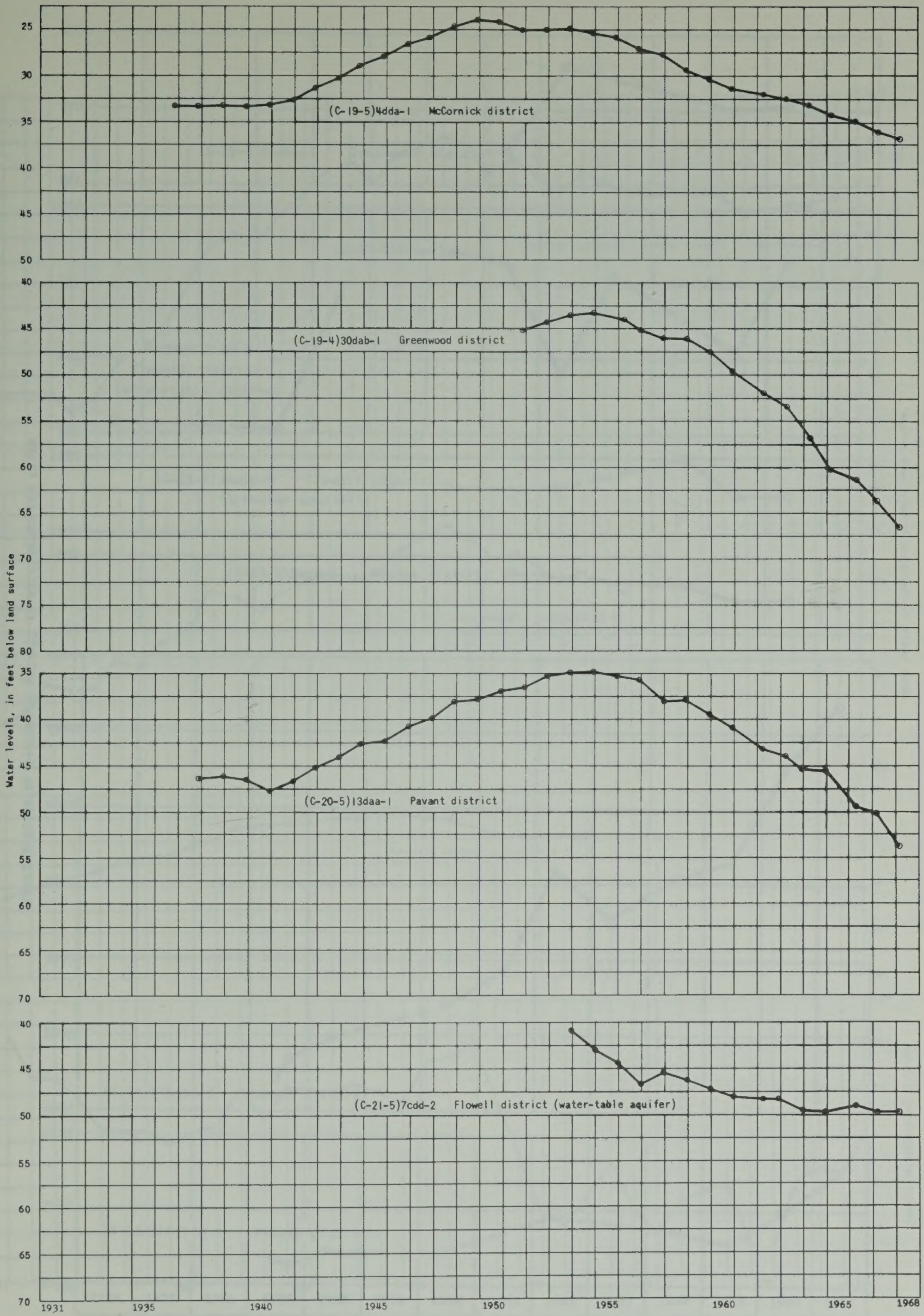


Figure 43.—Relation of water levels in selected wells in Pavant Valley to cumulative departure from the 1931-60 normal annual precipitation at Fillmore.

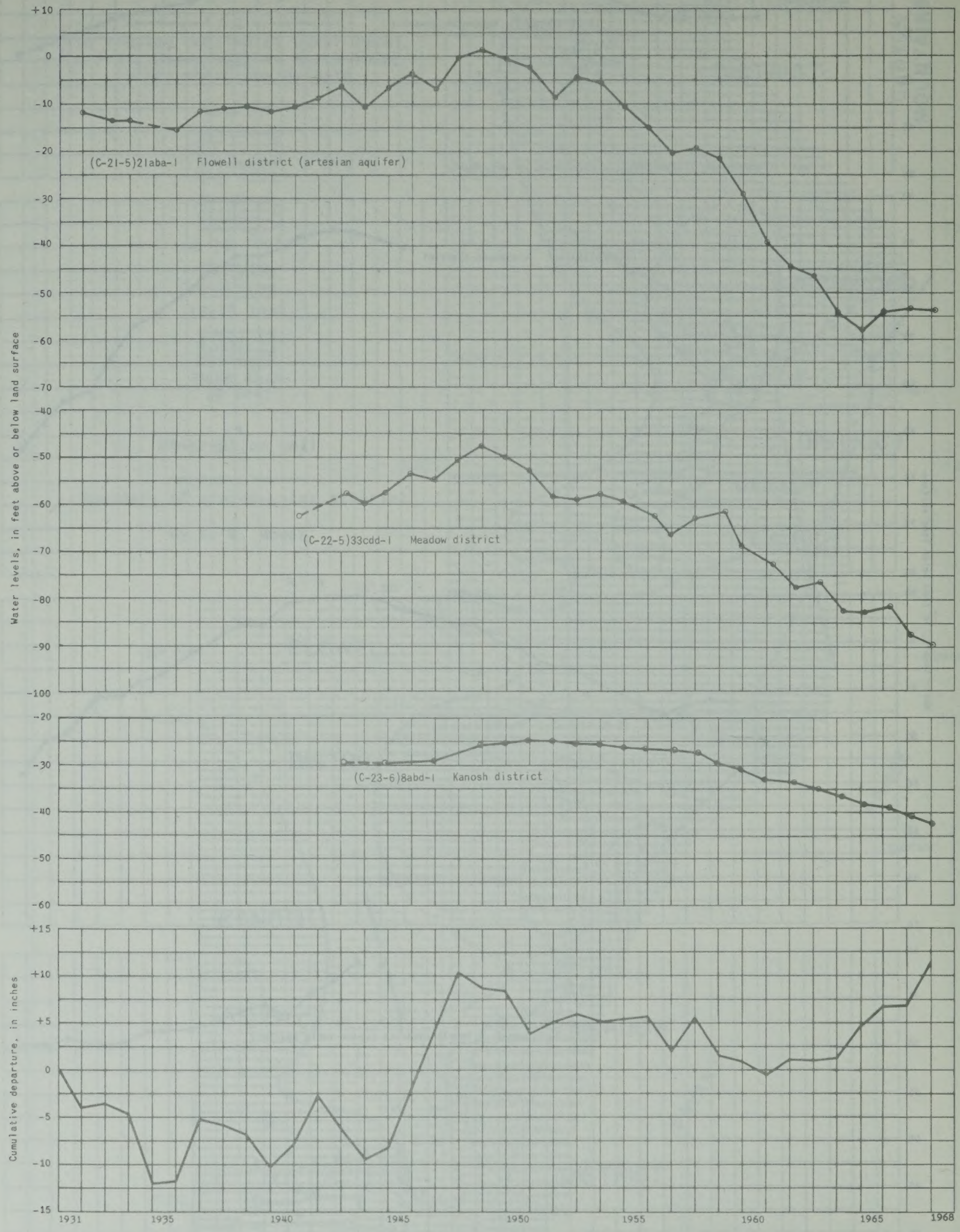


Figure 43.—Continued.

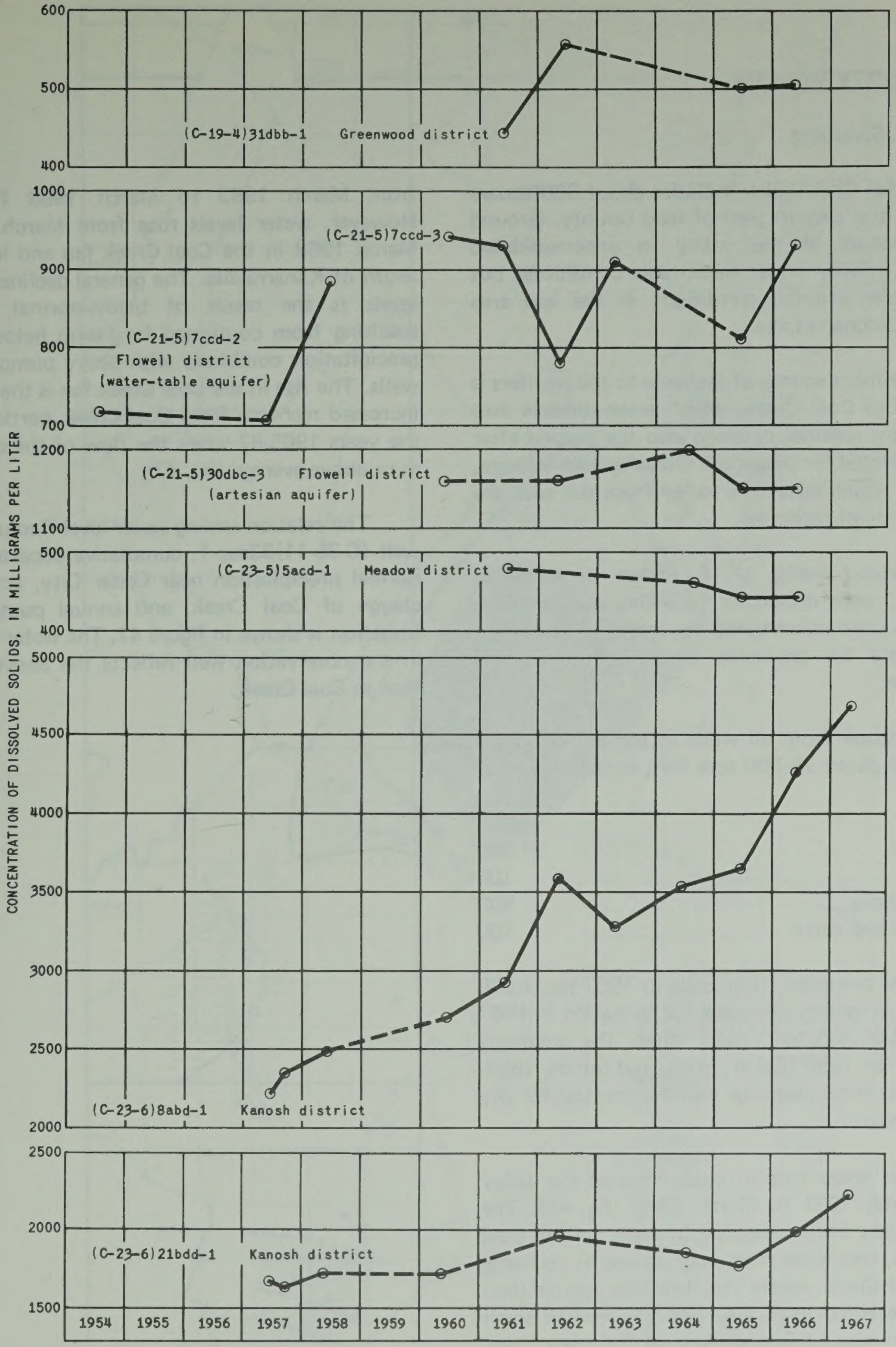


Figure 44.—Concentration of dissolved solids in water from six selected wells in Pavant Valley. (Concentrations calculated from determined constituents, except those for 1962 which were calculated from residue on evaporation at 180°C).

CEDAR CITY VALLEY

by G. W. Sandberg

Cedar City Valley includes about 300 square miles in the eastern part of Iron County. Ground water occurs in the valley in unconsolidated deposits, mostly under water-table conditions; but it is under artesian conditions in the low area around Quichapa Lake.

The main source of recharge to the aquifers is water from Coal Creek, which seeps directly into the stream channel or seeps into the ground after being diverted for irrigation. Other smaller streams, most of which enter the valley from the east, are also sources of recharge.

Thirteen wells, all 6 inches or more in diameter, were drilled in the valley during 1967. Six wells were constructed for irrigation and seven wells were for domestic, stock, industrial, and other uses.

Pumpage from all wells in the valley during 1967 was about 25,800 acre-feet, broken down as follows:

Irrigation	24,800
Industry	100
Public supply	800
Domestic and stock	150

Total pumpage from wells in 1967 was 1,000 acre-feet more and pumpage for irrigation in 1967 was 1,100 acre-feet more than the amounts reported for 1966 (Baker, Price, and others, 1967, p. 74); the total pumpage was the greatest for any year of record.

Water levels rose in most parts of the valley from March 1967 to March 1968 (fig. 45). The greatest rises were measured in wells on the Coal Creek fan, and these rises were caused by recharge from Coal Creek, where the flow was greater than in the preceding year. Declines occurred in small areas northwest of Enoch, west of Quichapa Lake, and in the vicinity of Kanarraville.

Water levels declined in most of the valley from March 1963 to March 1968 (fig. 46). However, water levels rose from March 1963 to March 1968 in the Coal Creek fan and in an area south of Kanarraville. The general decline of water levels is the result of below-normal recharge resulting from continued long-term below-normal precipitation combined with heavy pumping from wells. The rise in the Coal Creek fan is the result of increased recharge from Coal Creek, particularly in the years 1965-67 when the flow of the creek was at or above average (fig. 47).

The relation among water-level fluctuations in well (C-35-11)33aac-1, cumulative departure from normal precipitation near Cedar City, annual discharge of Coal Creek, and annual pumpage for irrigation is shown in figure 47. The water-level rise in the observation well reflects the above-average flow in Coal Creek.

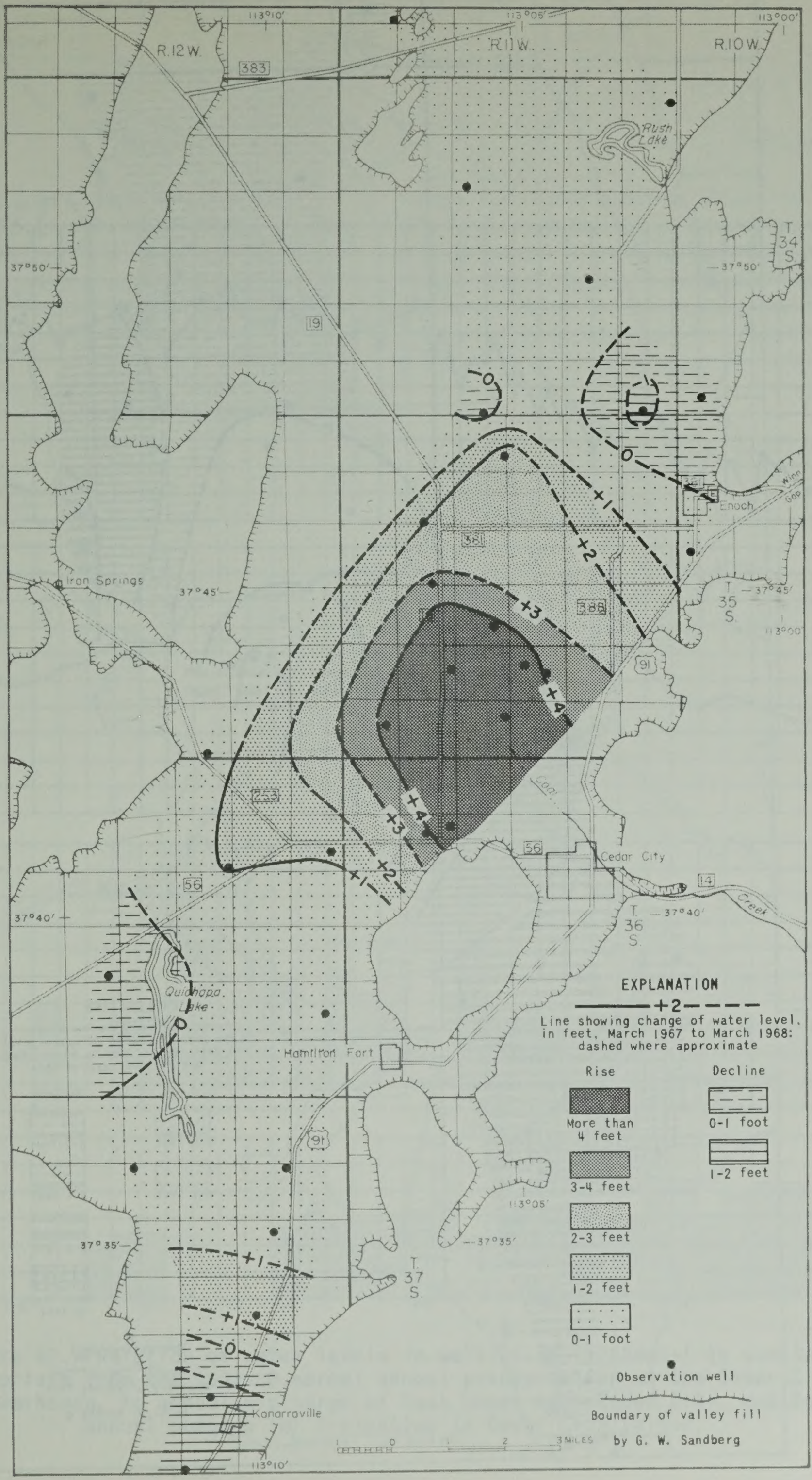


Figure 45.—Map of Cedar City Valley showing change of water levels from March 1967 to March 1968.

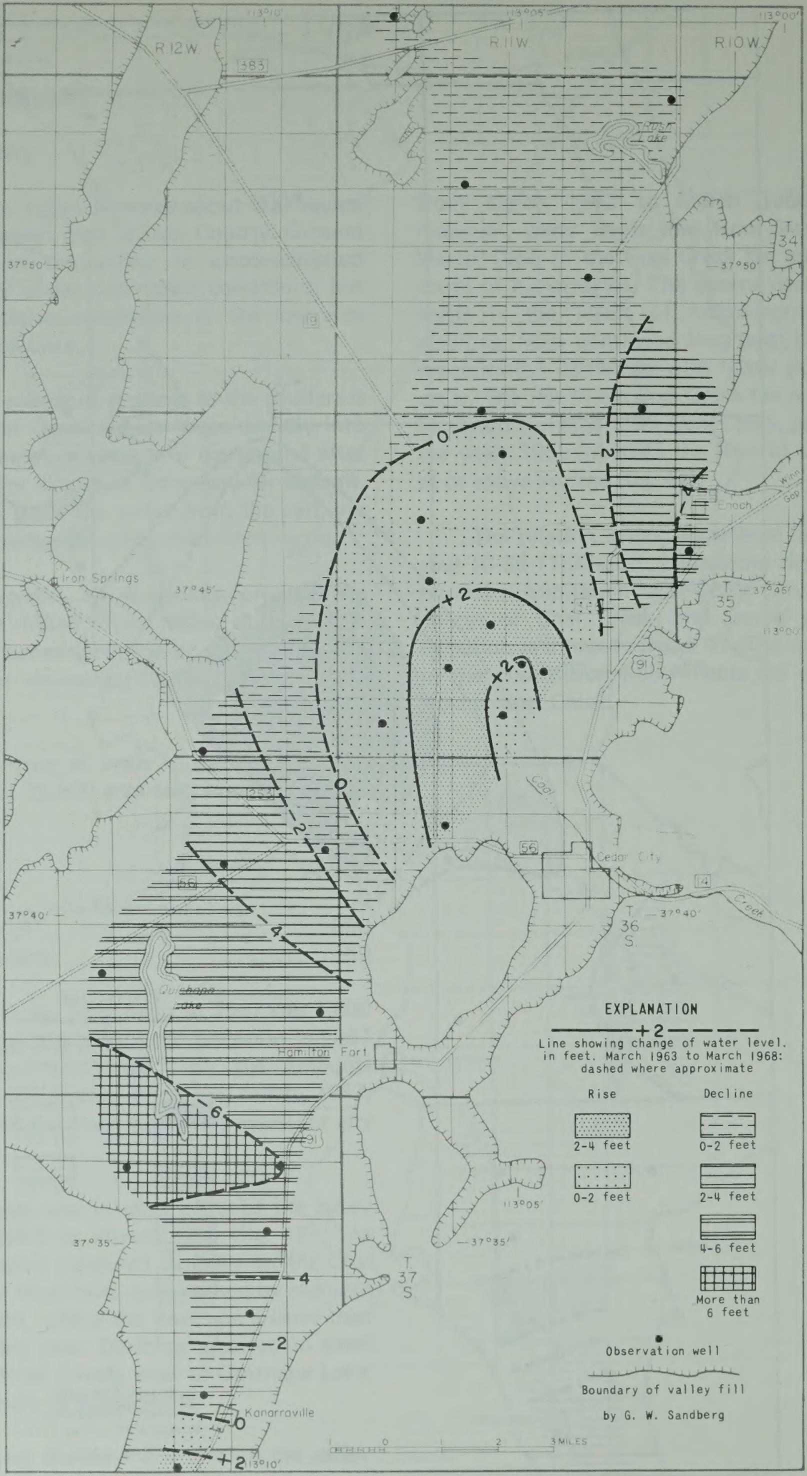


Figure 46.—Map of Cedar City Valley showing change of water levels from March 1963 to March 1968.

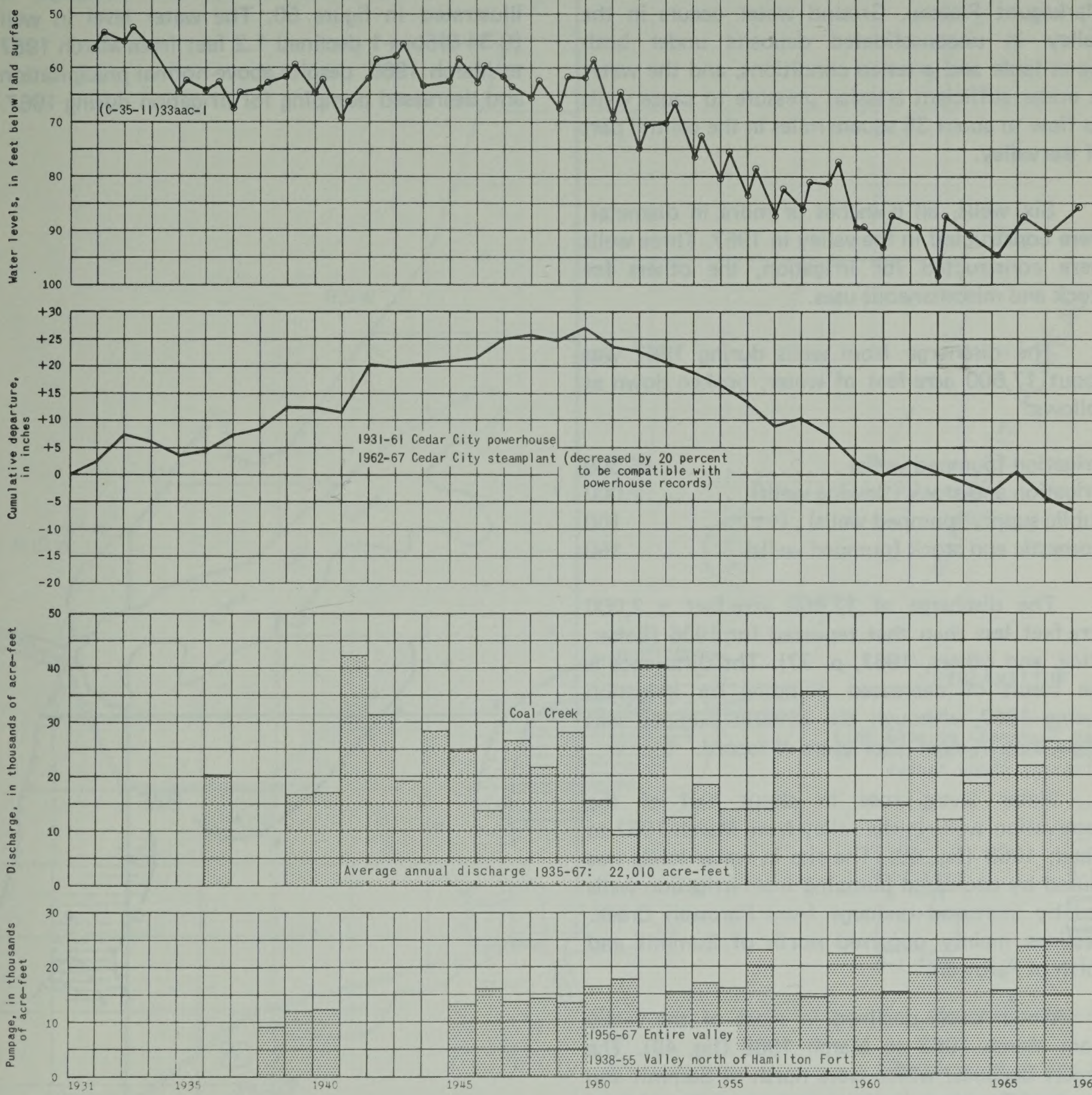


Figure 47.—Relation of water levels in well (C-35-11)33aac-1 to cumulative departure from the 1931-60 normal annual precipitation at the Cedar City powerhouse, to annual discharge of Coal Creek near Cedar City, and to annual pumpage for irrigation in Cedar City Valley.

PAROWAN VALLEY

by G. W. Sandberg

Parowan Valley includes about 150 square miles in Iron County at the western foot of the Markagunt Plateau. Ground water occurs in the valley in unconsolidated deposits under both water-table and artesian conditions, and the water is under sufficient artesian pressure to cause wells to flow in about 35 square miles in the central part of the valley.

Six wells, all 6 inches or more in diameter, were constructed in the valley in 1967. Three wells were constructed for irrigation, the others for stock and miscellaneous uses.

The discharge from wells during 1967 was about 17,600 acre-feet of water, broken down as follows:

Irrigation (pumped wells)	15,300
Irrigation and stock (flowing wells)	2,000
Public supply (pumped wells)	100
Domestic and stock (pumped wells)	150

The discharge of 17,600 acre-feet is 2,000 acre-feet less than that reported for 1966 (Baker, Price, and others, 1967, p. 77). The difference is the result of decreased pumping for irrigation during 1967, although the amount pumped was larger than in most prior years of record.

Water levels rose in about half of the observation wells in the valley from March 1967 to March 1968 (fig. 48). The rise in water levels was caused by decreased pumping from irrigation wells and by increased recharge from Parowan Creek. Declines mainly occurred north of Summit and north of Parowan.

Water levels declined in most of the valley from March 1963 to March 1968 (fig. 49). The largest declines, which were north of Summit and north of Parowan, in places were more than 4 feet. The declines were caused by the large withdrawals from wells for irrigation which resulted in total discharge exceeding the recharge to the aquifers.

The long-term relation among fluctuations of water levels, precipitation, and pumpage is illustrated in figure 50. The water level in well (C-34-8)5bca-1 declined 1.2 feet from March 1967 to March 1968, despite above-normal precipitation and decreased pumping for irrigation during 1967.

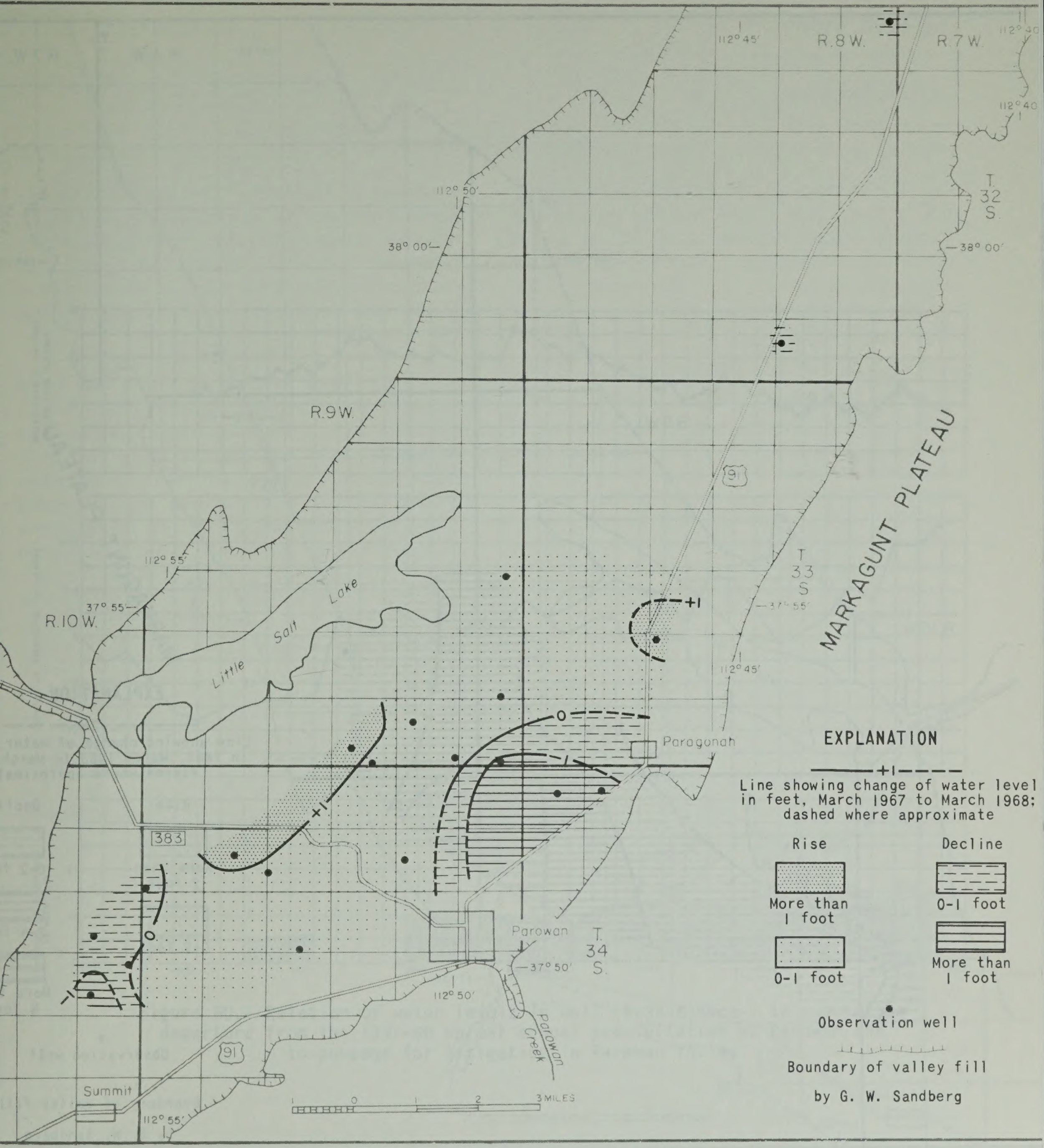


Figure 48.—Map of Parowan Valley showing change of water levels from March 1967 to March 1968.

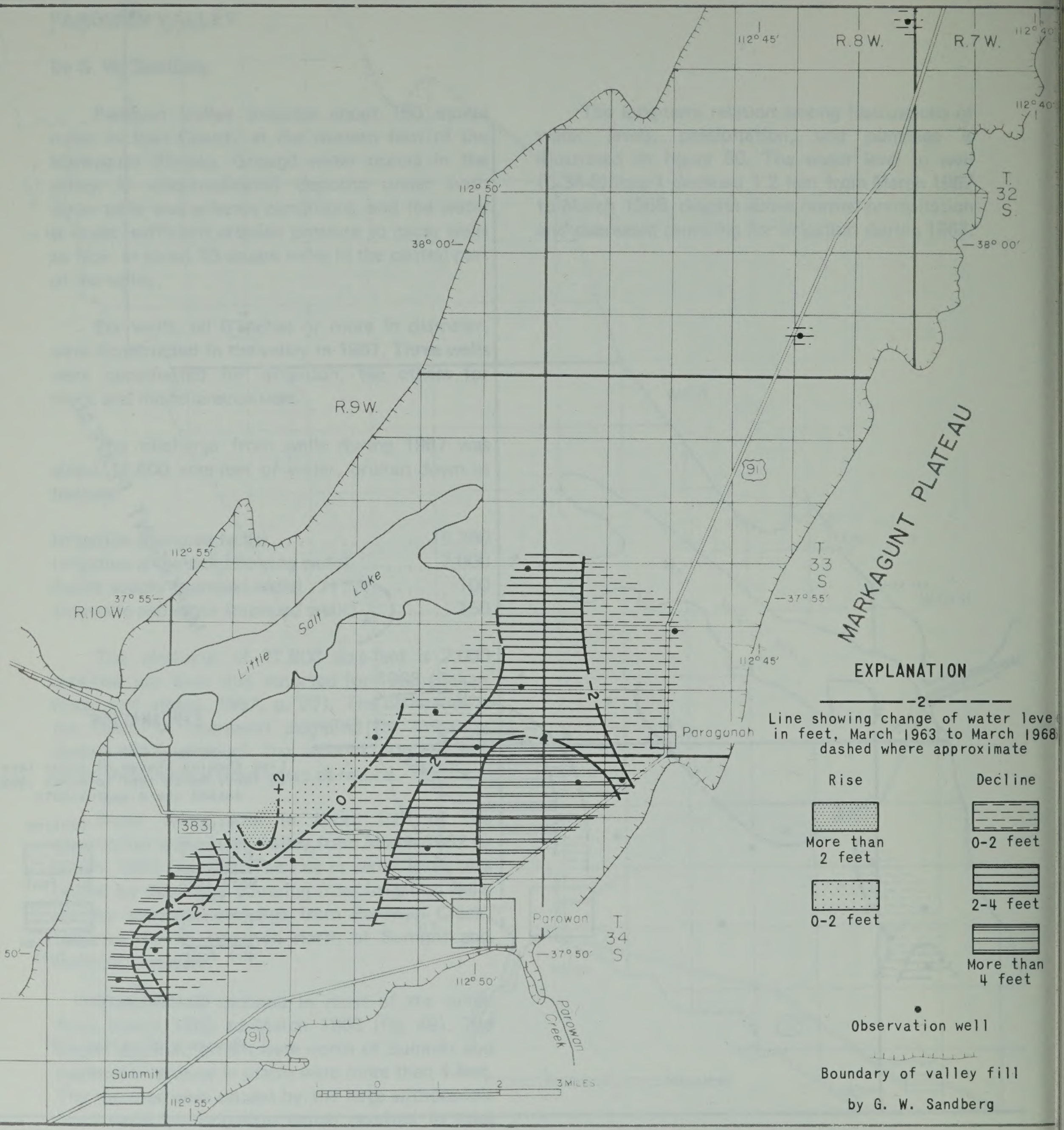


Figure 49.—Map of Parowan Valley showing change of water levels from March 1963 to March 1968.

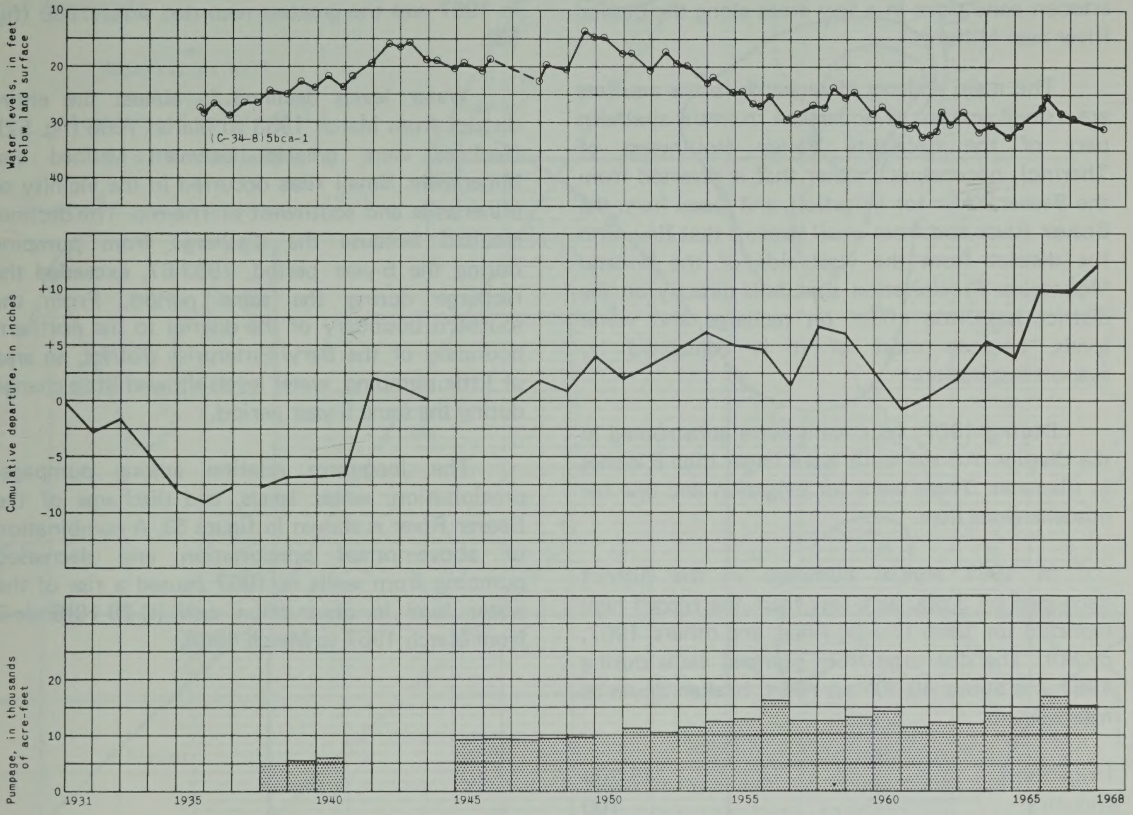


Figure 50.—Relation of water levels in well (C-34-8)5bca-1 to cumulative departure from the 1931-60 normal annual precipitation at Parowan and to pumpage for irrigation in Parowan Valley.

ESCALANTE VALLEY

by G. W. Sandberg

MILFORD DISTRICT

The Milford district includes approximately 300 square miles in the northern part of the Escalante Valley. Ground water occurs in the district in unconsolidated deposits, mostly under water-table conditions, but the water is under artesian conditions in a few areas along the Beaver River near Milford.

The main sources of recharge to the aquifers are a small amount of underflow from the southern part of the Escalante Valley (southwest of Thermo), unconsumed water that is diverted from the Beaver River for irrigation, and losses from the Beaver River and from small streams that flow into the district from the west side of the Mineral Mountains. Precipitation that falls directly on the district has little effect on recharge and water levels, because most of it is consumed by evapotranspiration.

During 1967, four wells were constructed in the district. All the wells were larger than 6 inches in diameter. Three were for irrigation and one for miscellaneous uses.

In 1967 annual pumpage in the district decreased by 3,600 acre-feet from the record high reported for 1966 (Baker, Price, and others, 1967, p. 80). The discharge from pumped wells during 1967 was about 46,600 acre-feet, broken down as follows:

Irrigation	45,700
Industry	100
Public supply	200
Domestic and stock	600

Water levels declined in most of the district from March 1967 to March 1968 (fig. 51). However, water levels rose more than 2 feet in some parts of the heavily pumped area 8 to 14 miles northwest of Minersville and rose slightly in the vicinity of Minersville. The greatest declines were more than 1 foot in a small area about 4 miles northwest of Minersville. The rise in the heavily pumped area was due to a decrease in pumping for irrigation during 1967. The rise in the vicinity of Minersville probably resulted from increased recharge from the Beaver River, in which the flow in 1967 was the greatest recorded since 1959 (fig. 53).

Water levels declined in almost the entire district from March 1963 to March 1968 (fig. 52). Declines were greatest between Milford and Minersville. Small rises occurred in the vicinity of Minersville and southwest of Thermo. The declines resulted because the discharge from pumping during the 5-year period, 1963-67, exceeded the recharge during the same period. From the southern boundary of the district to the northern boundary of the Beryl-Enterprise district, an area of little pumping, water levels showed little change during the same 5-year period.

The long-term relation among pumpage, precipitation, water levels, and discharge of the Beaver River is shown in figure 53. A combination of above-normal precipitation and decreased pumping from wells in 1967 caused a rise of the water level in observation well (C-29-10)6ddc-2 from March 1967 to March 1968.

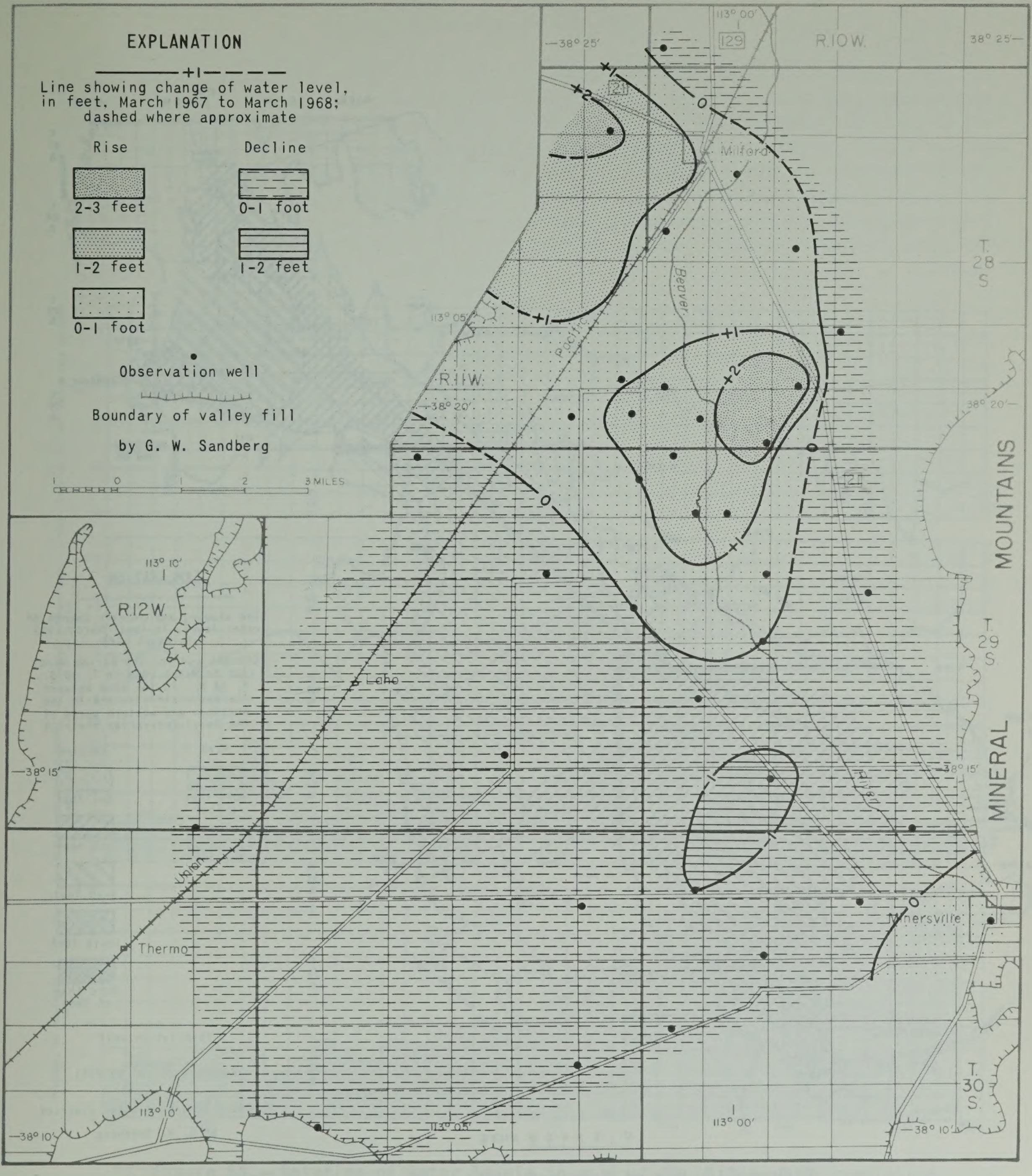


Figure 51.—Map of the Milford district, Escalante Valley, showing change of water levels from March 1967 to March 1968.

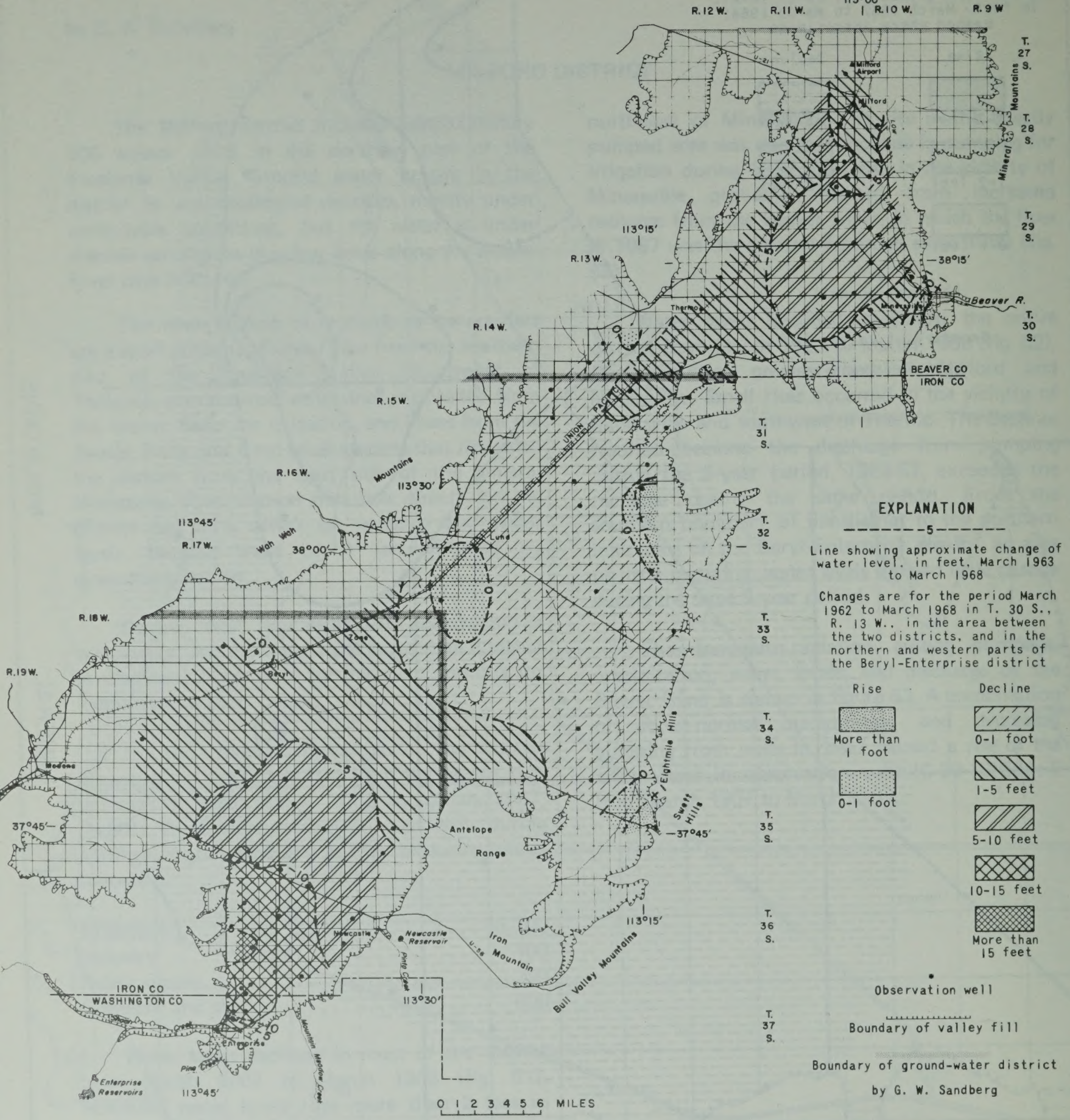


Figure 52.— Map of Escalante Valley showing change of water levels from March 1963 to March 1968.

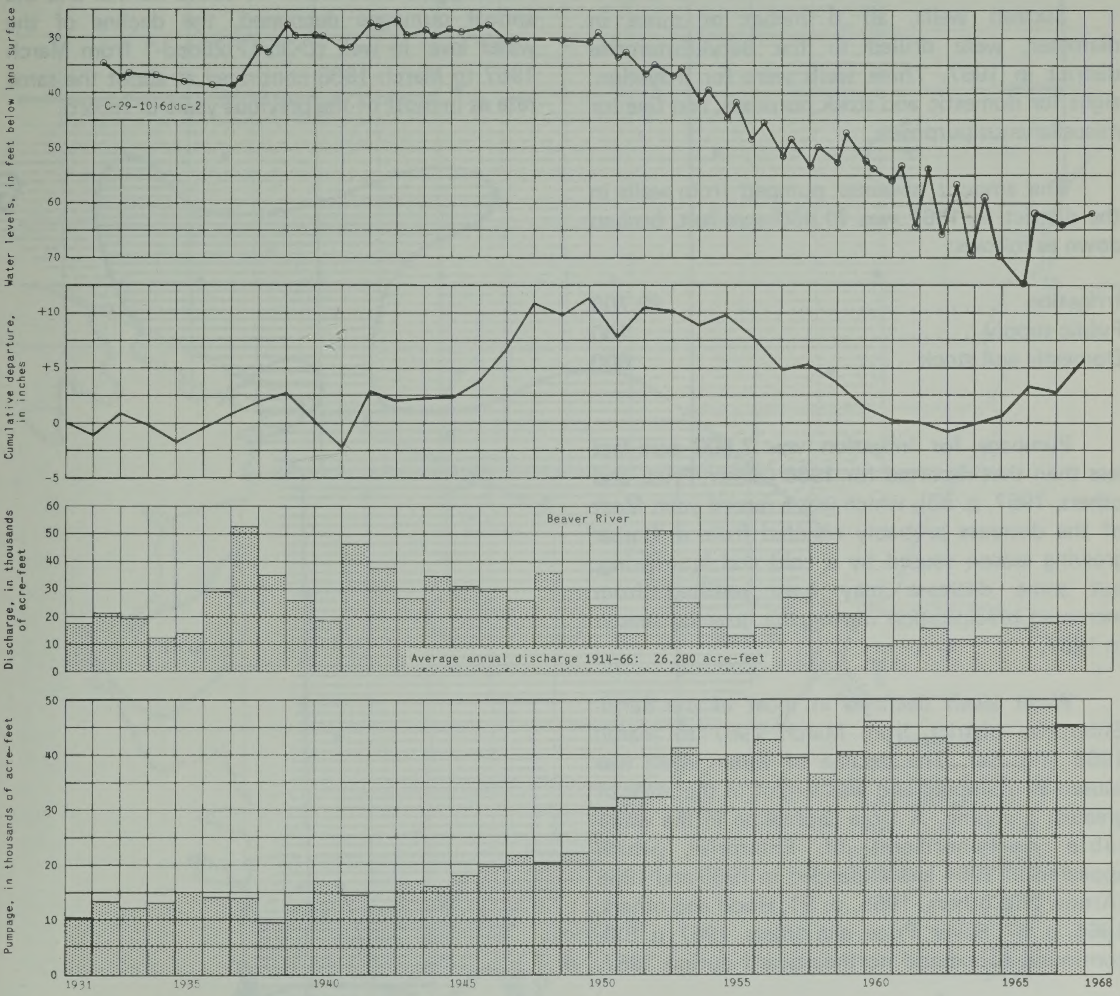


Figure 53.—Relation of water levels in well (C-29-10)6ddc-2 to cumulative departure from the 1931-60 normal annual precipitation at Milford airport, to pumpage for irrigation in the Milford district, and to discharge of Beaver River at Rockyford Dam near Minersville, Escalante Valley.

BERYL-ENTERPRISE DISTRICT

The Beryl-Enterprise district includes approximately 400 square miles in the southern end of Escalante Valley. Ground water occurs in unconsolidated deposits in the district, mostly under water-table conditions. Recharge to the aquifers comes mainly from Pinto, Meadow Valley, and Shoal Creeks, and from other small streams that enter the district from the mountains to the south.

Sixteen wells, all 6 inches or more in diameter, were drilled in the Beryl-Enterprise district in 1967. Three wells were for irrigation, eight for domestic and stock purposes, and five for miscellaneous purposes.

The amount of water pumped from wells in the district in 1967 was 71,400 acre-feet, broken down as follows:

Irrigation	70,700
Public supply	100
Domestic and stock	600

Pumpage for irrigation was 7,500 acre-feet less than that reported for 1966 (Baker, Price, and others, 1967, p. 83), which was a record year. Most of the decrease probably resulted from a shorter growing season caused by a cold and late spring, but some decrease may have resulted from increased precipitation during the growing season in 1967.

Water levels declined in most of the Beryl-Enterprise district from March 1967 to March 1968 (fig. 54). The decline of water levels was caused by pumping and was largest in the areas of greatest pumping. A large depression in the water table north-northeast of Enterprise, which appeared in 1964 and expanded in 1965 and 1966 (Arnow and others, 1965, p. 91; Hood and others, 1966, p. 87; Baker, Price, and others, 1967, p. 83), continued to expand northeastward during 1967.

Water levels declined in almost the entire district from March 1963 to March 1968 (fig. 52), and the declines were caused by pumping from wells for irrigation. The greatest decline was 17 feet in a well near the center of pumping; and the amount of decline decreased away from the center of pumping. A slight rise was recorded in an observation well near Enterprise, close to the area of recharge at Shoal Creek.

The long-term relation among water levels, precipitation, and pumpage is shown in figure 55. Although precipitation was above normal and the annual pumpage decreased, the decline of the water level in well (C-35-17)25dcd-1 from March 1967 to March 1968 continued at about the same rate as in most of the previous years of record.

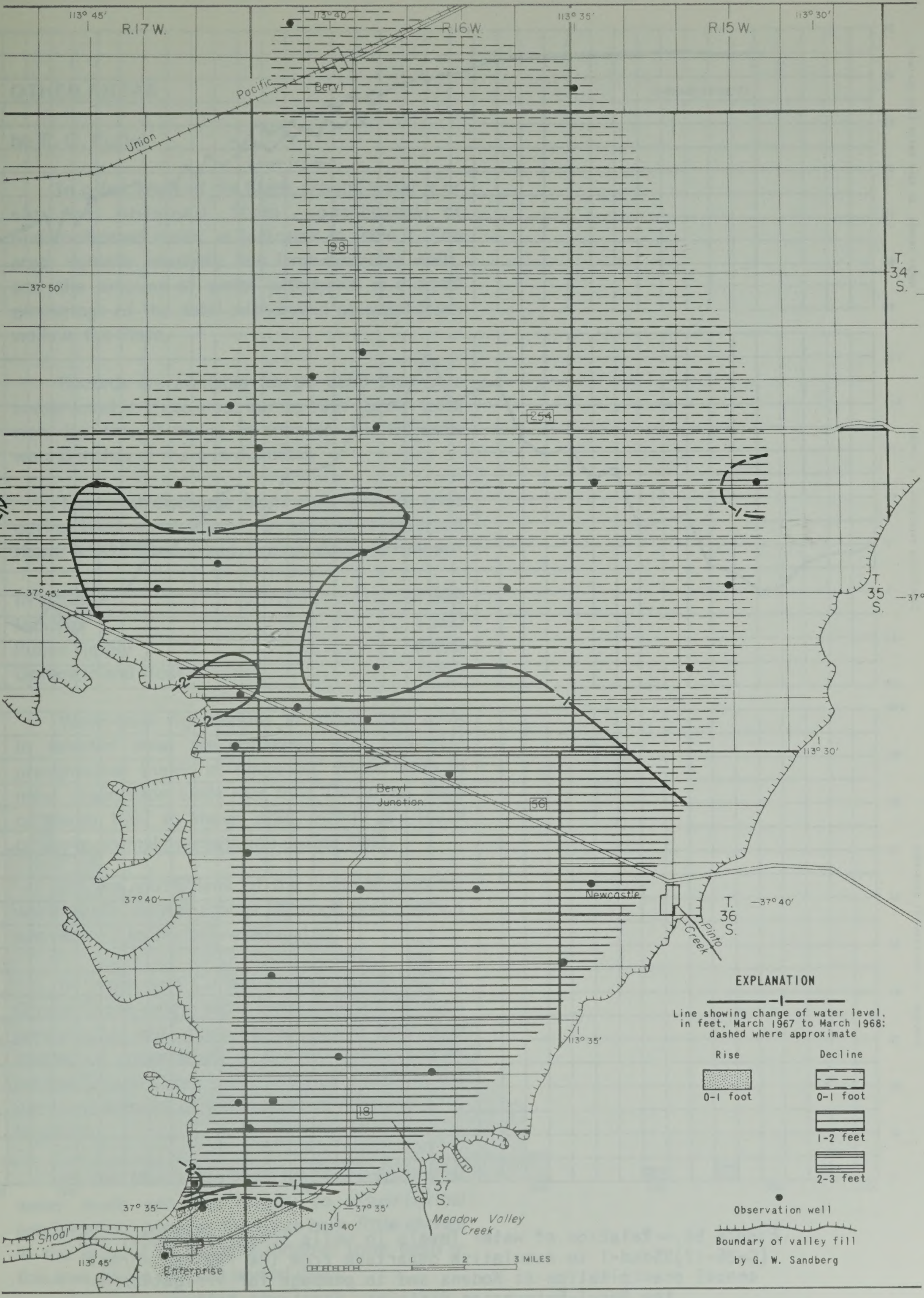


Figure 54.—Map of the Beryl-Enterprise district, Escalante Valley, showing change of water levels from March 1967 to March 1968.

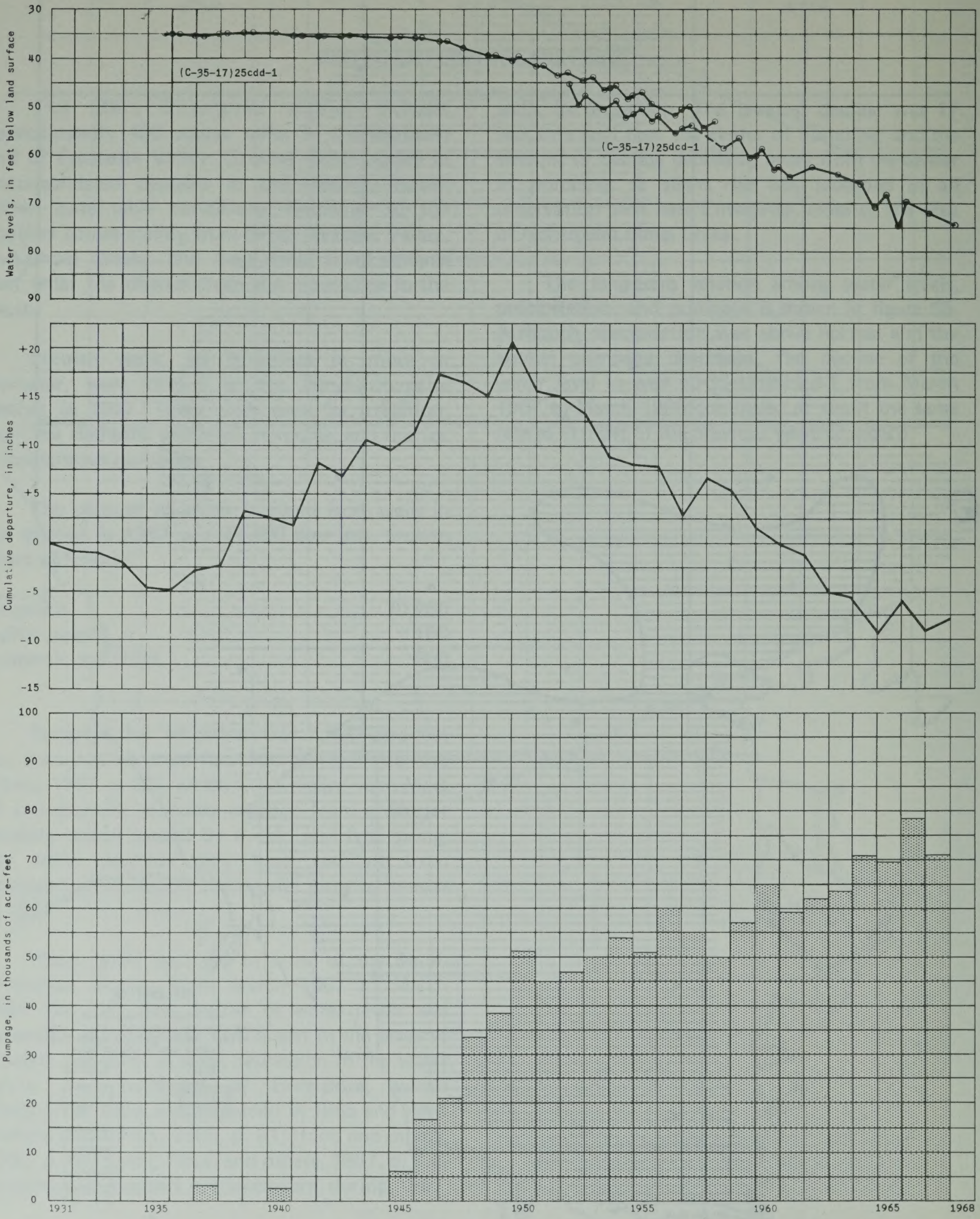


Figure 55.—Relation of water levels in wells (C-35-17)25cdd-1 and (C-35-17)25dcd-1 to cumulative departure from the 1931-60 normal annual precipitation at Modena and to pumpage for irrigation in the Beryl-Enterprise district, Escalante Valley.

OTHER AREAS

by R. G. Butler

In other areas of the State, ground water is or can be obtained from consolidated or unconsolidated rocks, as indicated in table 1. The areas contain relatively few large-discharge wells, and the amount of water withdrawn is a small percentage of the total withdrawal of water from wells in the State.

Records are available for 98 wells that were constructed in these areas during 1967. Seven wells were less than 6 inches in diameter and 91 wells were 6 inches or more in diameter.

The total discharge from wells in these areas during 1967 is not known; an estimated minimum figure is 40,700 acre-feet, broken down as follows:

Irrigation	31,900
Industry	1,200
Public supply	6,600
Domestic and stock	1,000

Water-level fluctuations in observation wells in selected areas are compared with long-term precipitation trends in figure 56. Water levels in most observation wells rose from December 1966 or March 1967 to March 1968, mainly as a result of above-normal precipitation during 1967.

On the south flank of the Uinta Mountains, water levels did not change although precipitation was nearly 2 inches below normal.

In Heber and Curlew Valleys and in central Grouse Creek valley, water levels declined although precipitation was above normal during 1967. The decline of water levels in Curlew Valley and in central Grouse Creek valley was due chiefly to the increased amount of water pumped from wells for irrigation.

In the Monticello area the slight decline of water levels was due chiefly to below-normal precipitation, because there has been little change in the amount of water withdrawn from wells in this area during the past several years.

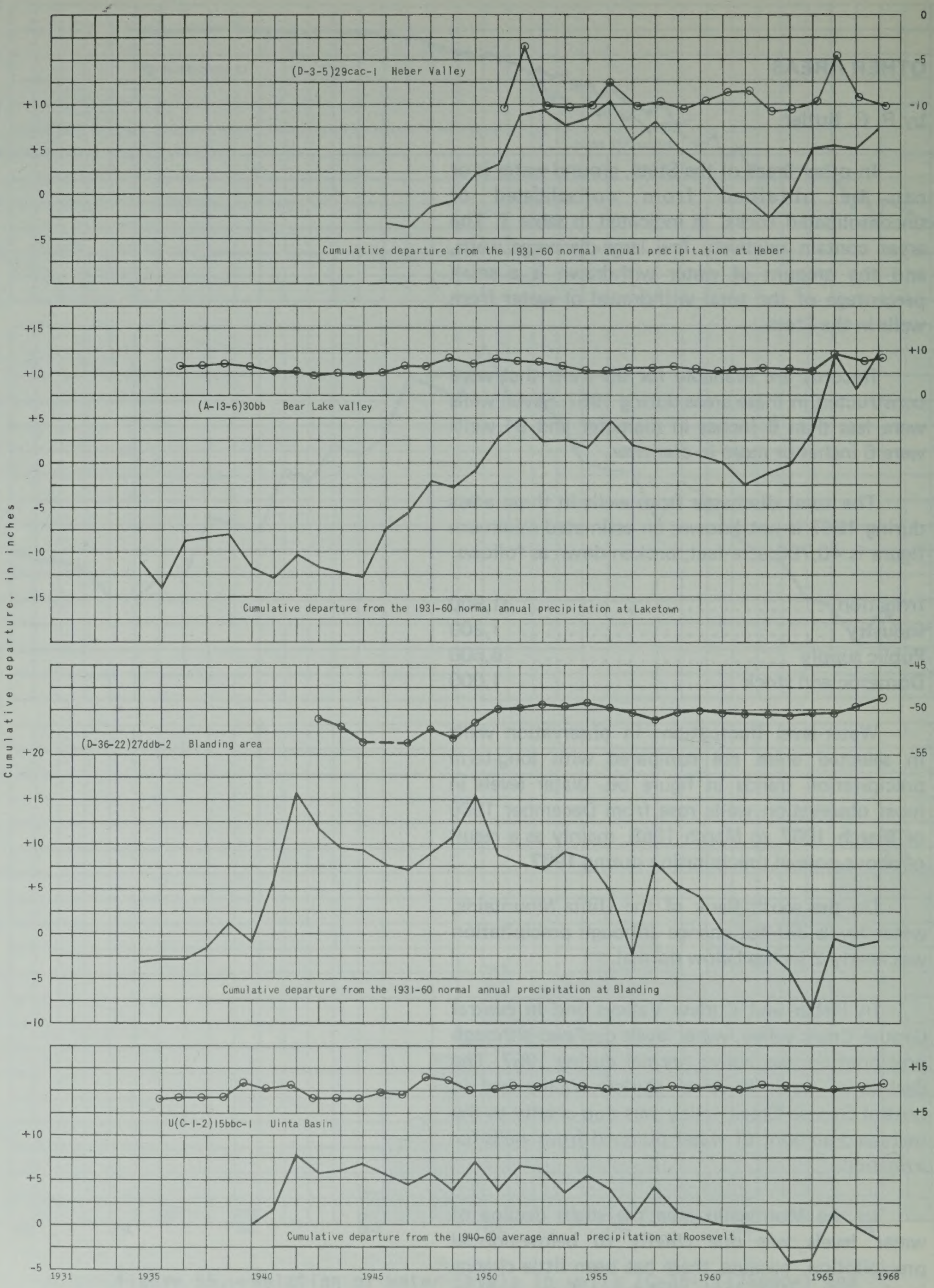
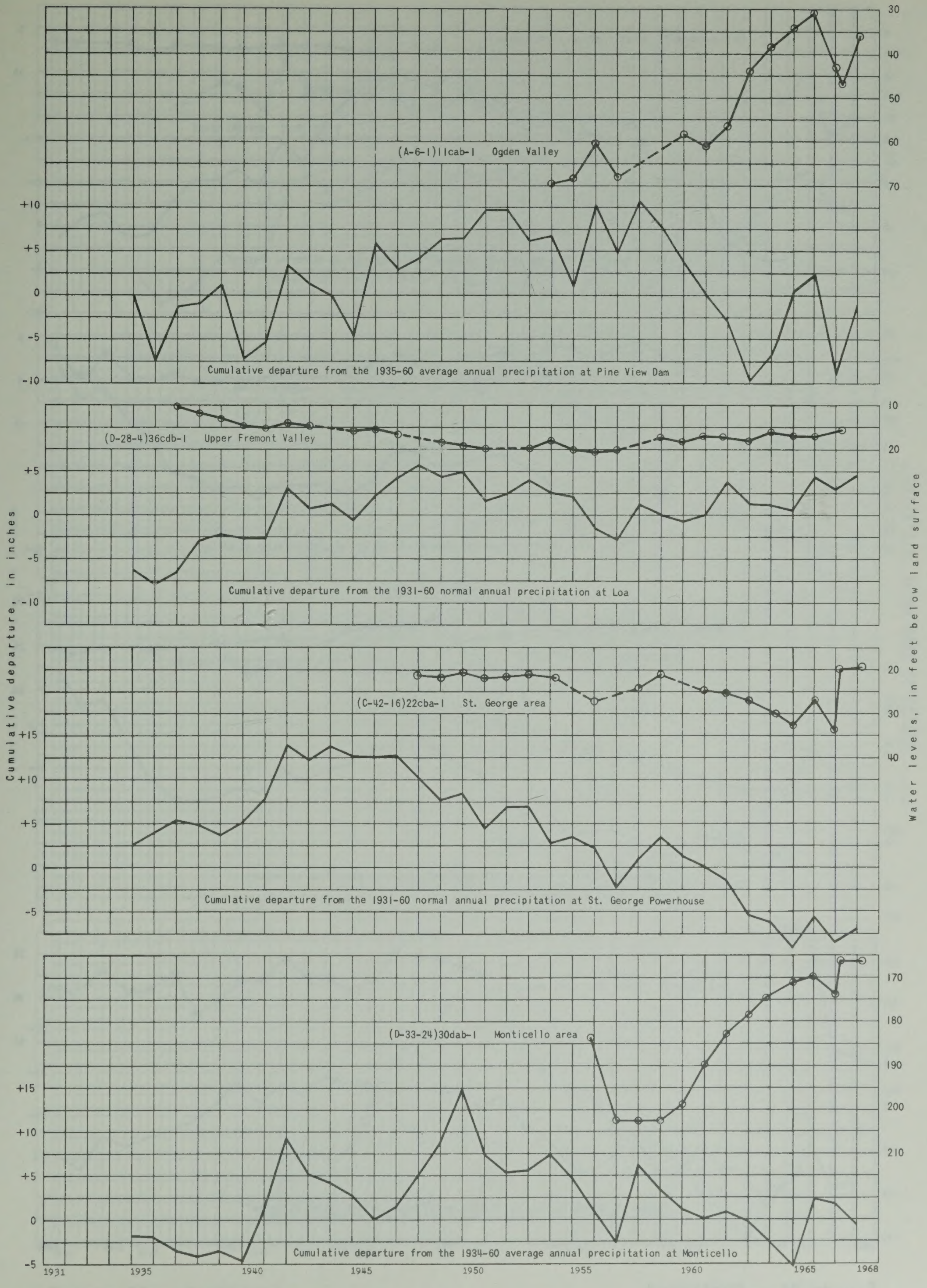


Figure 56.—Relation of water levels in wells in selected areas of Utah to cumulative departure from the average annual precipitation at sites in or near those areas.



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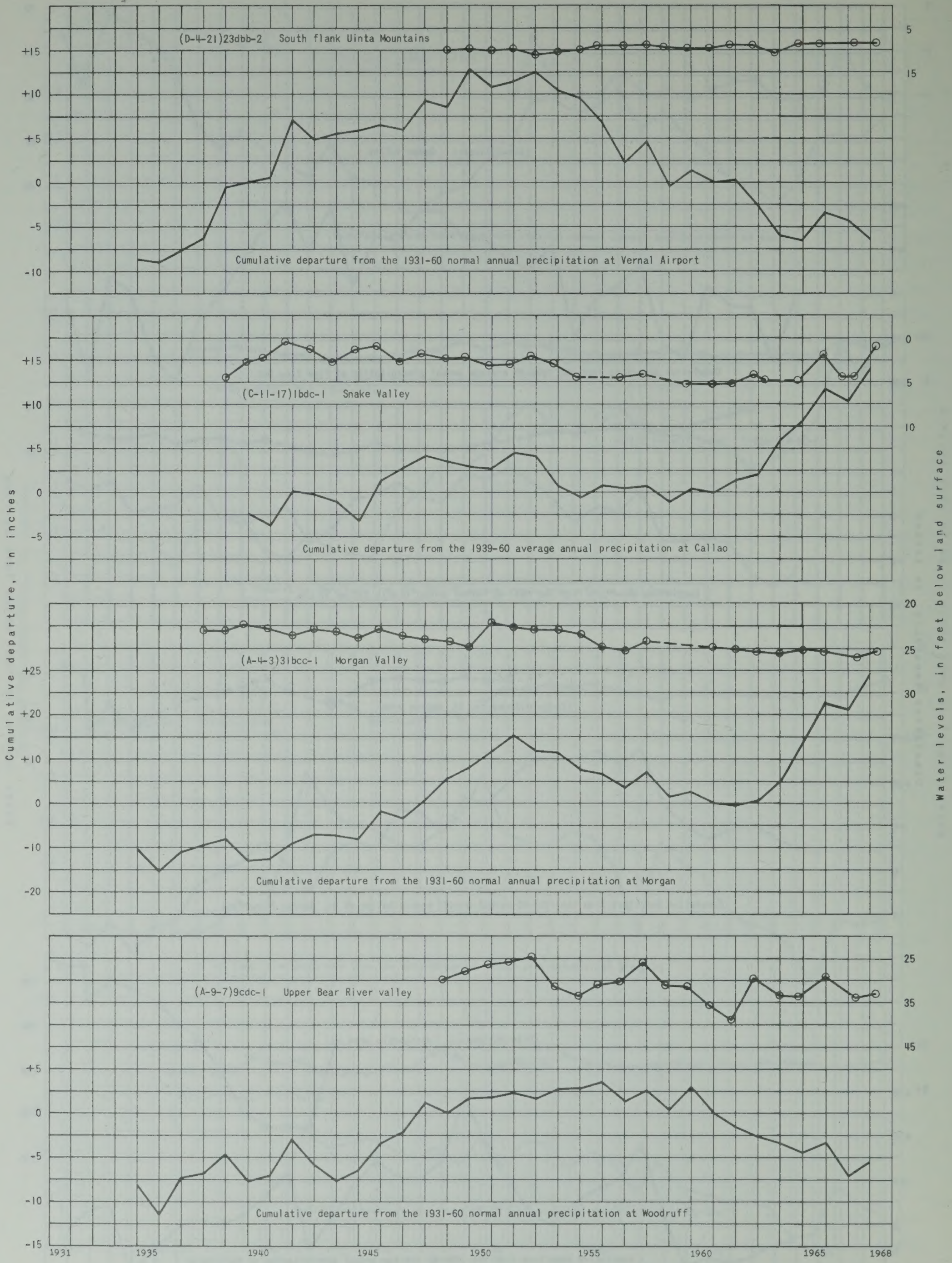

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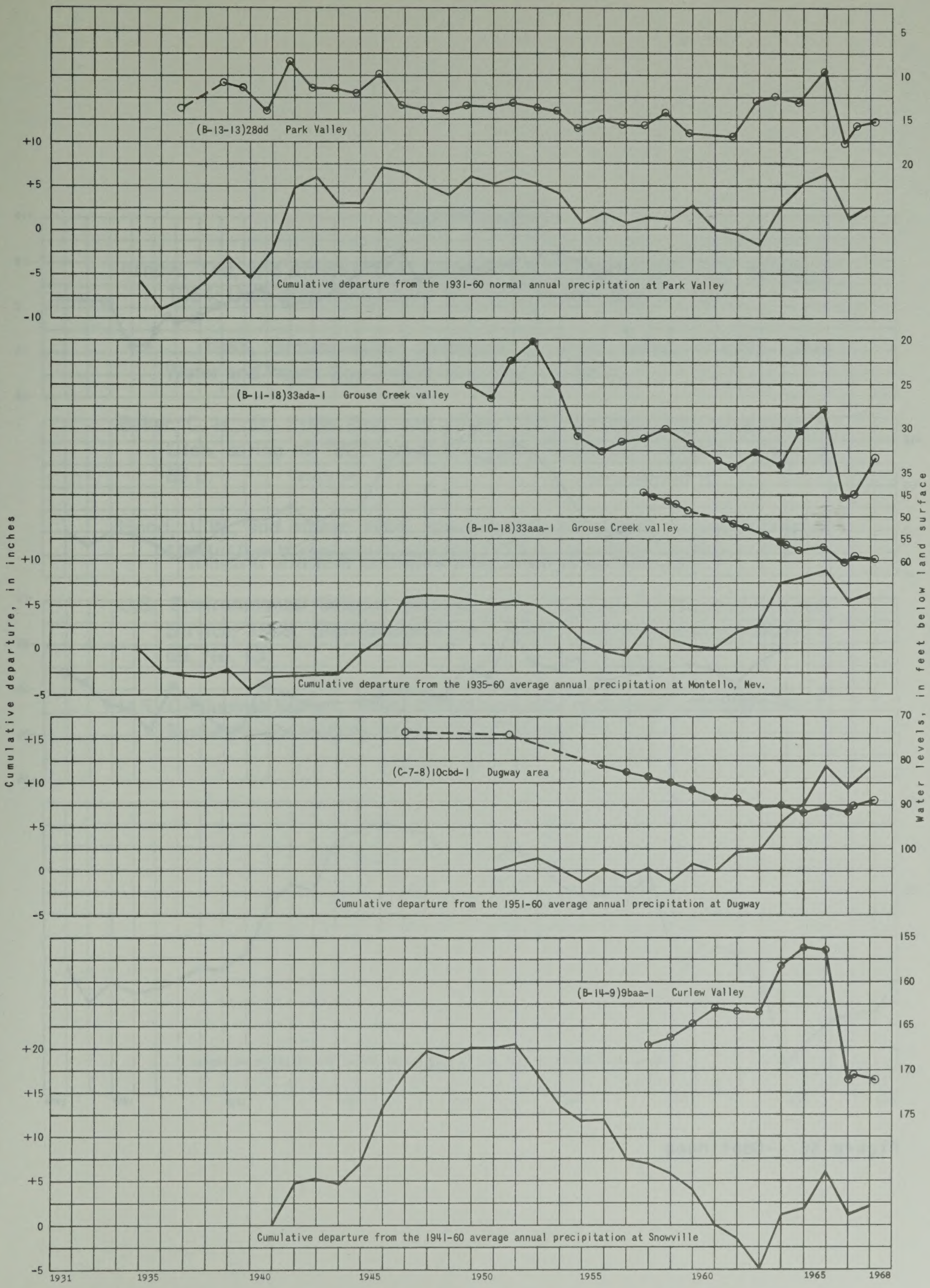

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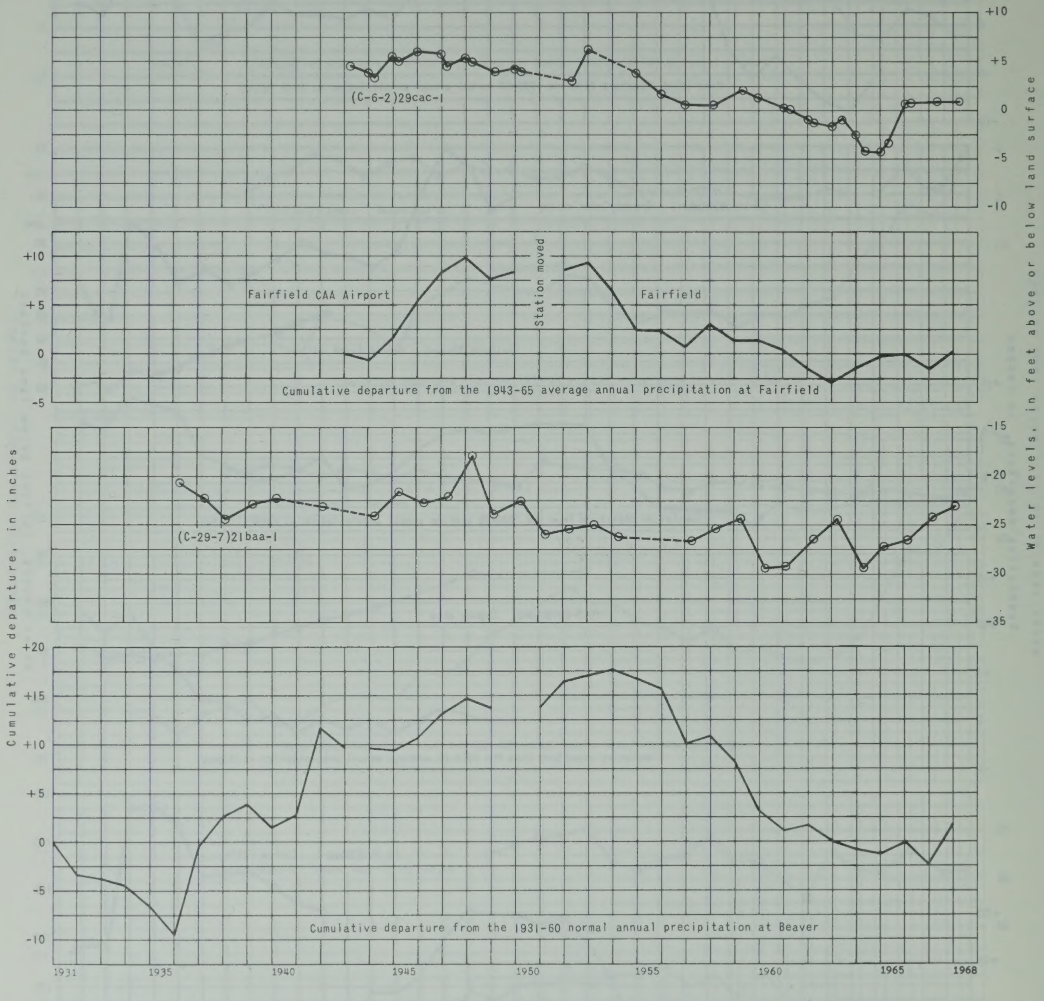

Figure 56.--Continued

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